Vol. 15, No. 22
November 30, 1990

Energy Research Abstracts

Abstracts 48071–50255

Office of Scientific and Technical Information
UNITED STATES DEPARTMENT OF ENERGY

The Office of Scientific and Technical Information

The Department of Energy's Scientific and Technical Information Program (STIP) is carried out at many levels within the Department and by its contractor organizations. The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, provides direction and leadership for STIP and serves as DOE's national center for scientific and technical information management and dissemination. Both DOE-originated information and worldwide literature regarding advances in subjects of interest to DOE researchers are collected, processed, and disseminated through the Energy Data Information System (EDIS) maintained by OSTI. The major databases in this system are available within the United States through commercial online systems and to those outside the United States through formal governmental exchange agreements. The current-year records for the major databases plus a number of specialized databases are available to DOE offices and contractors through OSTI's Integrated Technical Information System (ITIS). To manage DOE's information resources effectively, DOE's Scientific and Technical Information Program is one of continual development and evaluation of new information products, systems, and technologies.

UNITED STATES DEPARTMENT OF ENERGY
Office of Scientific and Technical Information
Post Office Box 62
Oak Ridge, Tennessee 37831

International Copyright. © U.S. Department of Energy, 1990, under the provisions of the Universal Copyright Convention.
United States copyright is not asserted under the United States Copyright Law, Title 17, United States Code.

Vol. 15, No. 22
November 30, 1990
ISSN: 0160-3604
CODEN: ERABD

Energy Research Abstracts

Purpose

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U.S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. Foreign information is obtained through the International Energy Agency's 14-nation Energy Technology Data Exchange, the International Atomic Energy Agency's International Nuclear Information System, or nation-to-nation agreements. **Please note that *ERA* coverage of nonreport literature is limited to that generated by Department of Energy activity.**

Scope

ERA is comprehensive in its subject scope, encompassing DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

The citations presented in *ERA* are available for online searching as records within the Energy Data Base. The current-year records are available on the Integrated Technical Information System (ITIS). The entire database is available through commercial online vendors.

Availability

DOE and DOE contractors who have OSTI deposit accounts can obtain *ERA* (regular issues and annual indexes) from the Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831, Attention: Information Services. For further information, call (615)576-8401, FTS 626-8401. *ERA* is also available at authorized GPO Depository Libraries. (List is provided on the inside back cover.)

ERA is available to the public on a subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The subscription rate for 24 semimonthly issues is $184.00 for domestic subscribers and $230.00 for foreign subscribers. A single issue costs $27.00, domestic, or $33.75, foreign. Cumulative indexes are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The GPO Stock Number is 061-000-00749-1 for the Volume 14 indexes.

Managing Editor, Audrey B. Smith
Technical Editor, Robert W. Rutkowski

Information Sources

The citations presented in *Energy Research Abstracts* are a subset of the worldwide energy information provided to the Office of Scientific and Technical Information (OSTI) through exchange agreements with foreign sources and through exchanges or contracts with U.S. organizations.

The **Energy Technology Data Exchange (ETDE)** was established by the International Energy Agency to promote cooperation among members in conducting appropriate energy-related research and development programs through the development of a formal central information sharing system. In accomplishing the objectives of the ETDE, members select, abstract, and index relevant research information published in their countries in accordance with Exchange standards. OSTI serves as the central receiving and processing center for this information, which it then disseminates to national centers in the participating countries. The following countries are currently members of the ETDE:

- Canada
- Denmark
- Finland
- France
- Federal Republic of Germany
- Italy
- Japan
- The Netherlands
- Norway
- Spain
- Sweden
- Switzerland
- United Kingdom
- United States

The **International Nuclear Information System (INIS)** was established to promote the exchange of information on nuclear science and technology. Its operation is similar to that of the ETDE, with the INIS Secretariat being located in Vienna, Austria. Currently, 75 countries and 14 international organizations are members of INIS. OSTI serves as the INIS national center for the United States.

In the exercise of its rights and responsibilities under the agreements to which it is a party, the **Office of Scientific and Technical Information** both receives information from the above sources and submits U.S.-produced information to them. In addition to materials generated by the Department of Energy, this U.S.-produced information is gathered from other government agencies as well as under contract with private information processing companies. All input is computer processed and entered into a database for online retrieval. The database serves as well for the production of numerous OSTI publications.

How To Read A Citation

The coverage of literature in this publication includes several document types, ranging from technical reports to journal articles to books. The principal data elements included in these citations are:

1. **Abstract number** within volume.
2. **Report number** identification for report-type literature.
3. **Title and subtitle** (non-English title may appear in parentheses, if applicable).
4. **Author(s).** First 10 names in the data record are printed, then "et al." is listed.
5. **Author affiliation.** Only first one is listed, in parentheses after author(s) to which it applies.
6. **Collaboration,** if present.
7. **Corporate author(s)** identifying corporation responsible for document.
8. **Patent assignee and number** for citations of patent documents or applications.
9. **Journal title, volume, and issue** for citations of journal articles.
10. **Date of publication.** If not known, a processing date is in brackets.
11. **Number of pages** or page range.
12. **Language** of document if non-English.
13. **Monograph title** if citation is an analytic (part, chapter, or paper) of a larger monograph.
14. **Publisher's name and location** for documents published by a corporate or commercial source.
15. **Sponsoring organization.**
16. **Contract or grant number.**
17. **Secondary identifying number;** may be a conference number.
18. **Conference title, location, and date,** if applicable.
19. **Order number.** The "DE" order number may be used for ordering from NTIS or OSTI, as appropriate. The "TI" prefix is valid only at OSTI.
20. **Sources of availability** from which a copy of the document may be obtained; usually appear as abbreviations. (See information on following page.)
21. **Drop note** or explanatory statement.
22. **Abstract.**
23. **Subject descriptors.** Listed only if no abstract or only a brief statement is included.

Sample Citations

Report

18494 (DOE/ER/40438–T1) **[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report.** Haeberli, W. Phys. VI collaboration. Wisconsin Univ., Madison (USA). Dept. of Physics. [1989]. 12p. Sponsored by DOE Energy Research. DOE Contract FG02-88ER40438. Order Number DE89007246. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper briefly discusses the Wisconsin test facility for storage cells; results of target tests; the new UHV...

Report Analytic

18500 (INIS-SU—69, pp. 30-32) **Transition energies in Ne-like ions. Correlation effects.** Vainshtejn, L.A. AN SSSR, Moscow. Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical physics. Collection.* Order Number DE89780060. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Kratkie Soobshcheniya po Fizike.; no. 6.

SILVER IONS/energy-level transitions; XENON IONS/energy-level transitions; CORRELATIONS; D STATES; E STATES;...

Journal Article

19055 **A theoretical and experimental investigation of long-pulse, electron-beam-produced rare gas plasmas.** Brake, M.L.; Repetti, T.E. (Energy Beam Interaction Lab. of the Dept. of Nuclear Engineering, Univ. of Michigan, Ann Arbor, MI (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science (USA)*, 16(5): 581-589 (Oct 1988). (CONF-881020–: Symposium on radiation physics, Sao Paulo, Brazil, October 3, 1988).

Visible emission spectroscopy (380-650 nm) has been performed on intense, electron beam (1 kA, 300 ns, 300 kV) produced Ar, Kr,...

Patent

18045 **Polarization of fast particle beams by collisional pumping.** Stearns, J.W. To Dept. of Energy, Washington, DC. USA Patent 4,724,117. 9 Feb 1988. Filed date 19 Oct 1984. vp. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

A method for polarizing a fast beam of particles by collisional pumping, comprising the steps of generating a beam...

How To Order from the Availability Sources

TO OBTAIN A REPORT

Report literature, usually identified by an alphanumeric identifier at the beginning of a citation, is available from the sources listed in the citation (see example of element 20 on page iii). Often the sources are listed as abbreviations. Corresponding addresses are provided at right from which documents with these abbreviations may be ordered. When "OSTI" is given, **DOE and DOE contractors may order these documents from OSTI.** (However, check with your library or information organization which may require that orders go through them to OSTI.) The public should order from NTIS or from one of the other agencies listed in the citation. To expedite processing, an order form is provided in the back of this publication. NOTE: The order numbers provide quicker access for report ordering. Use the order number where possible.

GPO Superintendent of Documents
Government Printing Office
Washington, DC 20402

GPO Dep. Available for inspection or interlibrary loan at Government Printing Office regional depository libraries.

INIS *Available only in microfiche.*
INIS Clearinghouse
International Atomic Energy Agency
P.O. Box 100, A-1400
Vienna, Austria

NTIS U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

OSTI U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

TO OBTAIN NON-REPORT LITERATURE

Non-report literature generally is available from the commercial publisher or corporation listed in the citation. These documents may also be available for loan from local libraries. First, check with the local library. Other sources of information are:

Journal articles *Chemical Abstracts Service Source Index (CASSI)* tells which libraries, both U.S. and foreign, contain a journal and the available years. *Ulrich's International Periodicals Directory* contains information on the journal and its publisher. For librarians, another source of information is On-Line Computer Library Center (OCLC), for interlibrary loans.

Books, conferences, and monographs The source for these publications is the publisher or the originating society, organization, or institution. DOE-supported conferences and individual papers reporting DOE-supported research may be available as reports from OSTI.

Foreign material The Linda Hall Library is an excellent source of foreign materials. For translations of foreign language material, contact the Library of Congress National Translation Center. For material difficult to locate, check with the British Library Document Supply Centre.

On-Line Computer Library Center
6565 Frantz Road
Dublin, OH 43107-0702
614-764-6000

Linda Hall Library
5109 Cherry Street
Kansas City, MO 64110
816-363-4600

Library of Congress
National Translation Center
Washington, D.C. 20540
202-707-0100

British Library Document Supply Centre
Boston Spa, Weatherby
West Yorkshire
LS23 7BQ
United Kingdom

How To Use the Indexes

Five indexes are provided for approaching the content of each issue of *Energy Research Abstracts*. Descriptions of entries in these indexes follow.

Corporate Author Index
The corporation, organization, or institution responsible for the issuance of the document is listed in this index. The entries are arranged alphabetically and provide the title and citation number of the reference. For example, the listing for the "Report" sample citation would appear as shown at right.

Wisconsin Univ., Madison (USA). Dept. of Physics
[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)
Wisconsin Univ., Madison (USA). Lab. of Genetics
Organization of the R chromosome region in maize: Final progress report, June 1, 1983–May 31, 1986, 15:18255 (R;US)

Personal Author Index
Each author's name listed on a document cited in this issue is indexed. An index entry provides title and citation number; for secondary and other names, a cross-reference is given to the primary author name where the full index entry is located.

Hadley, D.L., *See* Lee, A.D., 15:17651
Haeberli, W., [Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)

Subject Index
This index lists the main subject descriptors assigned to each record by indexing professionals. A secondary or qualifier term is used where necessary to describe materials, objects, and processes. Document titles may be enhanced with additional informative phrases where necessary. An excerpt from this index appears at right.

HYDROGEN ISOTOPES
See also DEUTERIUM
HYDROGEN 4
TRITIUM
Neutron-Rich Isotopes
Study on the strong neutron-rich nuclei of lightest elements, 15:18686 (RA;SU;In Russian)

Contract Number Index
DOE technical reports are listed by contract number. Each entry also provides the primary corporation or organization cited for that contract number. A typical entry is shown.

FG02-88ER40438 **Wisconsin Univ., Madison (USA). Dept. of Physics**
15:18494 DOE/ER/40438–T1
FG02-88ER60664 **Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)**
15:17641 DOE/ER/60664–1

Report Number Index
Technical report literature is indexed by the alphanumerical identifier of the report. Patent documents and conferences are included for convenience. Each entry lists the citation number, the source of availability of the document, an indicator of presence at a GPO depository library, order number, and distribution category. A typical entry is:

DOE/ER/40438–T1 15:18494 NTIS, PC A03/MF A01 - OSTI E 1.99: DE89007246 MF-411

Subject Contents

The subject content of *Energy Research Abstracts* is arranged as shown below. The two-digit and four-digit category numbers printed here illustrate the category number assignment used in the database records.* The following list includes all of the 39 first-level and the 308 second-level categories. Because each issue of *ERA* publishes citations only for those documents announced during the past semimonthly period, some subject categories may not be present in every issue.

Numerical Listing of Categories

01 COAL, LIGNITE, AND PEAT
- 03 Preparation
- 04 Processing
- 05 Products and By-Products
- 06 Properties and Composition
- 08 Waste Management
- 09 Environmental Aspects
- 10 Reserves, Geology, and Exploration
- 20 Mining
- 30 Transport, Handling, and Storage
- 40 Combustion
- 50 Economic, Industrial, and Business Aspects
- 60 Health and Safety
- 70 Legislation and Regulations

02 PETROLEUM
- 02 Reserves, Geology, and Exploration
- 03 Drilling and Production
- 04 Processing
- 05 Products and By-Products
- 06 Health and Safety
- 07 Economic, Industrial, and Business Aspects
- 08 Waste Management
- 09 Environmental Aspects
- 10 Legislation and Regulations
- 20 Transport, Handling, and Storage
- 30 Properties and Composition
- 50 Combustion

03 NATURAL GAS
- 02 Reserves, Geology, and Exploration
- 03 Drilling, Production, and Processing
- 04 Products and By-Products
- 05 Health and Safety
- 06 Economic, Industrial, and Business Aspects
- 07 Waste Management
- 08 Environmental Aspects
- 10 Legislation and Regulations
- 20 Transport, Handling, and Storage
- 30 Properties and Composition
- 40 Combustion

04 OIL SHALES AND TAR SANDS
- 02 Reserves, Geology, and Exploration
- 03 Drilling, Fracturing, and Mining
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 06 Products and By-Products
- 07 Health and Safety
- 08 Economic, Industrial, and Business Aspects
- 09 Waste Management
- 10 Environmental Aspects
- 20 Legislation and Regulations
- 30 Transport, Handling, and Storage
- 40 Combustion

05 NUCLEAR FUELS
- 01 Reserves, Exploration, and Mining
- 04 Feed Processing
- 05 Uranium Enrichment
- 07 Fuels Production and Properties
- 08 Spent Fuels Reprocessing
- 09 Transport, Handling, and Storage
- 10 Economic, Industrial, and Business Aspects
- 20 Waste Management
- 30 Environmental Aspects
- 40 Health and Safety
- 50 Safeguards, Inspection, and Accountability
- 60 Legislation and Regulations

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
- 01 Physical Isotope Separation
- 02 Radiation Sources
- 03 Isotopic Power Supplies
- 04 Economic, Industrial, and Business Aspects
- 05 Health and Safety

08 HYDROGEN
- 01 Production
- 02 Storage, Transport, and Handling
- 04 Economic, Industrial, and Business Aspects
- 05 Health and Safety
- 07 Products and By-Products
- 08 Properties and Composition
- 09 Environmental Aspects
- 10 Waste Management
- 20 Legislation and Regulations
- 30 Combustion

09 BIOMASS FUELS
- 07 Resources
- 08 Production
- 09 Processing
- 10 Properties and Composition
- 20 Combustion
- 30 Economic, Industrial, and Business Aspects
- 40 Transport, Handling, and Storage
- 50 Environmental Aspects
- 60 Health and Safety
- 70 Legislation and Regulations
- 80 Waste Management
- 90 Products and By-Products

10 SYNTHETIC FUELS
- 02 Production
- 03 Properties and Composition
- 04 Combustion
- 05 Transport, Handling, and Storage
- 06 Health and Safety
- 07 Economic, Industrial, and Business Aspects
- 08 Waste Management
- 09 Environmental Aspects
- 10 Legislation and Regulations
- 20 Products and By-Products

13 HYDRO ENERGY
- 01 Resources and Availability
- 02 Site Geology and Meteorology
- 03 Plant Design and Operation

*The numerical subject category scheme is used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's data systems. Categories and definitions for the complete set of six-digit numbers are given in DOE/TIC-4584, *Energy Data Base: Subject Categories and Scope.*

04 Legislation and Regulations
05 Economic, Industrial, and Business Aspects
06 Environmental Aspects
07 Power-Conversion Systems
08 Health and Safety

14 SOLAR ENERGY
01 Resources and Availability
03 Economic, Industrial, and Business Aspects
04 Environmental Aspects
05 Solar Energy Conversion
06 Photovoltaic Power Systems
07 Solar Thermal Power Systems
08 Ocean Energy Systems
09 Solar Thermal Utilization
10 Solar Collectors and Concentrators
20 Heat Storage
30 Health and Safety
40 Legislation and Regulations

15 GEOTHERMAL ENERGY
01 Resources and Availability
02 Geology and Hydrology of Geothermal Systems
03 Geothermal Exploration and Exploration Technology
04 Legislation and Regulations
05 Economic, Industrial, and Business Aspects
06 Environmental Aspects
07 Products and By-Products
08 Geothermal Power Plants
09 Geothermal Engineering
10 Direct Energy Utilization
20 Geothermal Data and Theory
30 Health and Safety
40 Waste Management

16 TIDAL AND WAVE POWER
01 Resources and Availability
03 Legislation and Regulations
04 Economic, Industrial, and Business Aspects
05 Environmental Aspects
07 Tidal Power Plants
08 Wave Energy Converters
09 Health and Safety

17 WIND ENERGY
01 Resources and Availability (Climatology)
03 Legislation and Regulations
04 Economic, Industrial, and Business Aspects
05 Environmental Aspects
06 Wind Energy Engineering
07 Health and Safety

20 FOSSIL-FUELED POWER PLANTS
01 Power Plants and Power Generation
02 Waste Management
04 Health and Safety
05 Environmental Aspects
06 Economic, Industrial, and Business Aspects
07 Legislation and Regulations

21 NUCLEAR POWER PLANTS
01 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled
02 Power Reactors, Nonbreeding, Light-Water Moderated, Nonboiling Water Cooled
03 Power Reactors, Nonbreeding, Graphite Moderated
04 Power Reactors, Nonbreeding, Otherwise Moderated or Unmoderated
05 Power Reactors, Breeding
06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
07 Regulation and Licensing
08 Economics

22 NUCLEAR REACTOR TECHNOLOGY
01 Theory and Calculation
02 Components and Accessories
03 Fuel Elements
04 Control Systems
05 Environmental Aspects
06 Research, Test, and Experimental Reactors
07 Plutonium and Isotope Production Reactors
08 Propulsion Reactors
09 Reactor Safety

24 POWER TRANSMISSION AND DISTRIBUTION
01 Power Systems
02 Power System Networks, Transmission and Distribution
03 Power Transmission Lines and Cables
04 Health and Safety
05 Environmental Aspects
06 Legislation and Regulations
07 Economic, Industrial, and Business Aspects

25 ENERGY STORAGE
01 Magnetic
02 Compressed and Liquefied Gas
04 Capacitor Banks
05 Flywheels
06 Thermal
08 Chemical
09 Batteries
10 Economic, Industrial, and Business Aspects
20 Health and Safety
30 Environmental Aspects
40 Legislation and Regulations

29 ENERGY PLANNING AND POLICY
01 Energy Analysis and Modeling
02 Economics and Sociology
03 Environment, Health, and Safety
04 Energy Resources
05 Research, Development, Demonstration, and Commercialization
06 Nuclear Energy
07 Transport and Storage
08 Heat Utilization
10 Conservation
20 Supply, Demand, and Forecasting
30 Policy, Legislation, and Regulation
40 Fossil Fuels
50 Hydrogen and Synthetic Fuels
60 Electric Power
80 Consumption and Utilization
90 Unconventional Sources and Power Generation

30 DIRECT ENERGY CONVERSION
01 MHD Generators
02 EHD Generators
03 Thermoelectric Generators
04 Thermionic Converters
05 Fuel Cells
08 Miscellaneous Converters

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
01 Buildings
02 Transportation
03 Industrial and Agricultural Processes
06 Municipalities and Community Systems
09 Education and Public Relations

33 ADVANCED PROPULSION SYSTEMS
01 Internal Combustion Engines
02 External Combustion Engines
03 Electric-Powered Systems
04 Hybrid Systems
05 Flywheel Propulsion
06 Vehicle Design Factors
07 Emission Control
08 Alternative Fuels

35 ARMS CONTROL
01 Policy, Negotiations, and Legislation
02 Proliferation
03 Verification

36 MATERIALS
01 Metals and Alloys

02 Ceramics, Cermets, and Refractories
06 Other Materials

40 CHEMISTRY
01 Analytical and Separations Chemistry
02 Inorganic, Organic, and Physical Chemistry
04 Electrochemistry
05 Photochemistry
06 Radiation Chemistry
07 Radiochemistry and Nuclear Chemistry
08 Combustion, Pyrolysis, and High-Temperature Chemistry

42 ENGINEERING
02 Facilities, Equipment, and Techniques
04 Heat Transfer and Fluid Flow
05 Materials Testing
10 Combustion Systems
20 Mining and Underground Engineering
30 Marine Engineering
50 Power Cycles
60 Components, Electron Devices and Circuits

43 PARTICLE ACCELERATORS
01 Design, Development, and Operation
02 Beam Dynamics, Field Calculations, and Ion Optics
03 Auxiliaries and Components
04 Storage Rings

44 INSTRUMENTATION
01 Radiation Instrumentation
02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
04 Well Logging Instrumentation
05 Thermal Instrumentation
06 Optical Instrumentation
07 Geophysical and Meteorological Instrumentation
08 Miscellaneous Instrumentation

45 MILITARY TECHNOLOGY, WEAPONRY, AND NATIONAL DEFENSE
01 Chemical Explosions and Explosives
02 Nuclear Explosions and Explosives
03 Nuclear Explosion Detection
04 Nuclear and Radiological Warfare
05 Strategic Defense Initiative
06 Chemical and Biological

54 ENVIRONMENTAL SCIENCES
01 Environmental Sciences, Atmospheric
02 Environmental Sciences, Terrestrial
03 Environmental Sciences, Aquatic

55 BIOMEDICAL SCIENCES, BASIC STUDIES
01 Behavioral Biology
02 Biochemistry
03 Cytology
04 Genetics
05 Metabolism
06 Medicine
07 Microbiology
08 Morphology
09 Pathology
10 Physiological Systems
20 Public Health
30 Agriculture and Food Technology

56 BIOMEDICAL SCIENCES, APPLIED STUDIES
01 Radiation Effects
02 Thermal Effects
03 Chemicals Metabolism and Toxicology
04 Other Environmental Pollutant Effects

57 HEALTH AND SAFETY

58 GEOSCIENCES

64 PHYSICS I
01 Astrophysics and Cosmology
02 Atmospheric Physics
03 Atomic, Molecular, and Chemical Physics
04 Fluid Physics
50 High Energy Physics
51 Particle Interactions and Properties—Experimental
52 Particle Interactions and Properties—Theoretical
53 Particle Invariance Principles and Symmetries
54 Field Theory

65 PHYSICS II
10 Nuclear Physics
11 Experimental Techniques
12-20 Nuclear Properties and Reactions
30 Nuclear Theory
40 Radiation and Shielding Physics
50 Medical Physics
60 Condensed Matter Physics
61 Superconductivity
70 Theoretical and Mathematical Physics

70 FUSION ENERGY
01 Plasma Research
02 Fusion Power Plant Technology

99 GENERAL AND MISCELLANEOUS
01 Management
02 Mathematics and Computers
03 Information Handling
04 Law

CORPORATE AUTHOR INDEX

PERSONAL AUTHOR INDEX

SUBJECT INDEX

CONTRACT NUMBER INDEX

REPORT NUMBER INDEX

ORDER NUMBER CORRELATION

Alphabetical Listing of Categories

33 ADVANCED PROPULSION SYSTEMS
35 ARMS CONTROL
09 BIOMASS FUELS
56 BIOMEDICAL SCIENCES, APPLIED STUDIES
55 BIOMEDICAL SCIENCES, BASIC STUDIES
40 CHEMISTRY
01 COAL, LIGNITE, AND PEAT
30 DIRECT ENERGY CONVERSION
32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
29 ENERGY PLANNING AND POLICY
25 ENERGY STORAGE
42 ENGINEERING
54 ENVIRONMENTAL SCIENCES
20 FOSSIL-FUELED POWER PLANTS
70 FUSION ENERGY
99 GENERAL AND MISCELLANEOUS
58 GEOSCIENCES
15 GEOTHERMAL ENERGY
57 HEALTH AND SAFETY
13 HYDRO ENERGY
08 HYDROGEN
44 INSTRUMENTATION
07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
36 MATERIALS
45 MILITARY TECHNOLOGY, WEAPONRY, AND NATIONAL DEFENSE
03 NATURAL GAS
05 NUCLEAR FUELS
21 NUCLEAR POWER PLANTS
22 NUCLEAR REACTOR TECHNOLOGY
04 OIL SHALES AND TAR SANDS
43 PARTICLE ACCELERATORS
02 PETROLEUM
64 PHYSICS I
65 PHYSICS II
24 POWER TRANSMISSION AND DISTRIBUTION
14 SOLAR ENERGY
10 SYNTHETIC FUELS
16 TIDAL AND WAVE POWER
17 WIND ENERGY

Energy Research Abstracts

01 COAL, LIGNITE, AND PEAT

0103 Preparation

Refer also to citation(s) 48083, 48084, 48085

48071 (CONF-900631–3) **Open-gradient magnetic separation for physical coal cleaning: Results for Pittsburgh No. 8 and Upper Freeport coals.** Doctor, R.D.; Livengood, C.D. Argonne National Lab., IL (USA). [1990]. 8p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From International conference on pollution prevention: clean technologies and clean products–the environmental challenge of the 1990's; Washington, DC (USA); 10-13 Jun 1990. Order Number DE90017663. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Open-Gradient Magnetic Separation (OGMS) using superconducting quadrupole magnets offers a novel beneficiation technology for removing pyritic sulfur from pulverized dry coal. It is estimated to have a power demand 75% lower than techniques using conventional electromagnets, while achieving higher separation forces. Additionally, the system operates in a continuous mode and uses no chemicals. Because OGMS is specifically applicable to finely ground coal (120–325 mesh), its development could encourage the commercialization of other unconventional coal technologies, such as coal-water slurries, fluidized-bed combustion, and synfuels. 3 figs., 1 tab.

48072 (DOE/PC/89909–T1) **In-plant testing of microbubble column flotation: Technical progress report second quarter, January 1, 1990–March 31, 1990.** Yoon, R.H.; Luttrell, G.H.; Adel, G.T. Virginia Center for Coal and Minerals Processing, Blacksburg, VA (USA). [1990]. 27p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-89PC89909. Order Number DE90017895. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the past year, a joint project between the US Department of Energy (DOE), the Virginia Center for Coal and Minerals Processing (VCCMP) and the Shell Mining Corporation (SMC) was initiated to implement the testing of a full-scale microbubble flotation column. The work is being carried out at the Marrowbone Preparation Plant, located near Naugatuck in southwestern West Virginia. The primary objective of this effort was to determine the feasibility of using microbubble column flotation for the recovery of coal fines from a classifying cyclone overflow stream that is presently being discarded as refuse. During the past quarter, results obtained using a 30-inch diameter test unit were reviewed, flowsheet layouts and preliminary scale-up projections were generated and design, engineering, fabrication and installation of the full-scale test unit was completed. Preliminary results were also obtained with the full-scale test unit and are presented in this report. 5 figs., 7 tabs.

48073 (PB–90-250143/XAB) **Assessment of physical coal-cleaning practices for sulfur removal. Final report, April 1986-January 1990.** Herhal, A.J.; Minnucci, C. Science Applications International Corp., Norristown, PA (USA). Jun 1990. 173p. Contracts EPA-68-02-3893, EPA-68-02-4397. Source: NTIS, PC A08/MF A01.

The report presents results of a study of the current level of coal cleaning activity in the United States. In 1983, the U.S. Department of Energy's Energy Information Administration (EIA) expanded coal data collection activities to include information on the extent and type of coal preparation conducted in each coal-producing region. The additional information included data on raw coal input to coal cleaning plants, clean coal output, quality characteristics of the prepared coal, and end-use markets of both raw and prepared coal. These data, in combination with other EIA data, provide information on the extent and type of coal cleaning activity in each major coal-producing state or region. The impact on coal preparation of differences in mining methods and requirements of the various end-use markets also is discussed. Estimates were developed of SO2 emission reduction by current mechanical cleaning plants based on clean coal quality characteristics reported to EIA and bed/county raw coal quality estimated from the EIA/U.S. Bureau of Mines analytical file.

0104 Processing

Refer also to citation(s) 48489, 48490, 49738

48074 (CRIE-U–89032) **Bioprocessing of coal. 1.: Microorganisms for coal processing.** Kimura, K.; Omura, N.; Saiki, H.; Kono, Y. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Nov 1989. 39p. (In Japanese). Order Number DE91701409. Source: NTIS (US Sales Only), PC A03/MF A01.

In the bioprocessing of coal using biotechnology, desulfurizing microorgaisms were examined. 30-70% of total sulfur in coal is occupied by inorganic sulfur, almost of that is a form of FeS_2. Using some acidophilic sulfur oxidizing bacteria such as Thiobacillus ferrooxidans and Thermophilic-acidophilic bacterial such as Sulfolobus acidocaldarius, about 90% of inorganic sulfur in coal can be removed in 1 or 2 weeks in pulverized coal-water slurry, a high possibility in practical use is shown. Organic sulfur (total sulfur – inorganic sulfur) is difficult to be removed, since it is combined with carbon in a from of covalent bond. Sulfolobus acidocaldarius can remove both inorganic and organic sulfur simultaneously. One mutant strain of Pseudomonas is excellent at the rate of desulfurization. These organisms must be superior to others, but their desulfurization ratios are generally low. Some bacteria can degrade some kinds of low-rank coals into water soluble liquid fuel, and the ash content is decreased. Bioconversion of low-rank coals to methane gas applying methane enzyme principle, has been proposed, however, still an idea. 81 refs., 5 figs., 15 tabs.

48075 (DOE/PC/80016–T9) **Improved Fischer-Tropsch Synthesis catalysts for indirect coal liquefaction: Quarterly technical progress report No. 8, 1 July–30 September 1987.** Tong, G.T.; Wilson, R.B.; McCarty, J.G. SRI International, Menlo Park, CA (USA). [1987]. 7p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-85PC80016. Order Number DE90017887. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The monoruthenium cluster catalyst with a molecular sieve support and the tetraruthenium cluster catalyst with a sodium-Y zeolite support have been examined for Fischer-Tropsch Synthesis (FTS) performance at high pressure (6.9 MPa) in a slurry reactor and compared with conventional ruthenium with an alumina support and clean fused iron catalysts. Of the four catalysts tested, only the conventional ruthenium catalyst exhibited a chain growth factor of 0.88 and a methane selectivity of 6.6%, which are typical of slurry reactor results reported for iron catalysts under similar conditions. The other three catalysts tested showed low chain growth factors (ranging from 0.44 to 0.57) and high methane selectivity (ranging from 20 to 32%). A cobalt catalyst with approximately 50% sulfur coverage was prepared and tested for FTS activity and selectivity at ambient pressure and compared with the FTS performance of the clean and fully sulfided cobalt catalysts. The introduction of sulfur caused a decrease in methane selectivity and an increase in olefin selectivity with only a moderate decline in activity. 1 ref., 2 tabs.

48076 (DOE/PC/88800–26) **Stable carbon isotope analysis of coprocessing materials: Quarterly technical progress report, July 1–September 30, 1989.** Winschel, R.A.; Lancet, M.S.; Burke, F.P. Consolidation Coal Co., Library, PA (USA). Research and Development Dept. Jul 1990. 95p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88800. Order Number DE90016792. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Consol R&D is developing and demonstrating stable carbon isotope analysis as a method to quantitatively distinguish coal-derived and petroleum-derived carbon in products from coal/petroleum coprocessing. The approach taken is to develop the method, then

demonstrate its application on authentic continuous-unit products. The significance of selective isotopic fractionation is being determined and, if necessary, corrections will be applied to account for it. Precision, accuracy and range of applicability are being defined. The value of accessory analytical techniques also is being assessed. The program is designed to address a substantial, demonstrated need of coprocessing research (both exploratory and development) for a technique to quantitatively distinguish the contributions of the individual coprocessing feedstocks to the various products. The carbon isotope technique currently is in routine use for other applications. Progress is discussed. 7 refs., 7 figs., 12 tabs.

48077 (DOE/PC/88802–T5) **Exploratory coprocessing research: Quarterly report No. 7, March 1, 1990–May 31, 1990.** Hirschon, A.S.; Tse, D.S.; Malhotra, R.; McMillen, D.F.; Ross, D. SRI International, Menlo Park, CA (USA). 26 Jul 1990. 10p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88802. Order Number DE90017248. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objectives of this project are to: (1) study the scope of hydrothermal pretreatment of coal on subsequent conversion, (2) identify and study the chemical or physical causes of this effect, and (3) attempt to elucidate the chemistry responsible for any coal-resid synergisms. This quarter we investigated and compared several known methods of pretreatment under coprocessing conditions. These experiments were conducted in our microreactor system, where the reactors are agitated by an electric reciprocating saw. Since Wyodak coal was shown to be susceptible to pretreatment this coal was used for these comparisons, using pretreatments at 350°C, and a ratio of 1 part coal and 2 parts Maya ATB. Hydrogen pressure was 1200 psig (cold) and reaction temperature 425°C. Pretreatment methods included acidic acetone, thermal, hydrothermal, and tetralin pretreatments. The use of acetone was prompted by the interesting results of Baldwin et al, where they were able to increase the reactivity of low rank coals by pretreatment with acidic methanol. The thermal treatment was used as a baseline case for the other pretreatments, and the tetralin pretreatment is an example of pretreating with a potential liquefaction solvent. The results showed that the aqueous pretreatment techniques at 350°C gave the best overall conversions. 5 refs., 1 fig., 1 tab.

48078 (DOE/PC/90014–T7) **Upgrading Fischer-Tropsch naphtha.** Gregor, J.H.; Fullerton, H.E. UOP, Inc., Des Plaines, IL (USA). 18 Dec 1989. 113p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-86PC90014. Order Number DE90017621. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Reforming of Fischer-Tropsch (F-T) naphtha was studied. This report documents a pilot plant study, and its translation into economic evaluations of various alternatives for upgrading F-T naphtha into a high-octane gasoline blending stock. There is a significant economic advantage to reform naphtha at low pressure (50 psig) as opposed to high pressure (125 psig). This is particularly true for the extremely lean naphtha produced by F-T synthesis. For the case of a 40,000 BPD unit processing a full-boiling range (FBR) Arge naphtha, an additional 5.4 vol % yield is obtained at low pressure. This translates into 767,000 bbl of additional reformate over the course of a year. Process economics are closely related to liquid product yield, and the additional reformate yield of the 50 psig operation adds over $29,000/day to the gross margin. Although the low pressure unit has a larger catalyst regenerator (more capital) and has a higher utility consumption, the after-tax IRR increases by a factor of 1.3 as pressure is reduced from 125 to 50 psig because of the yield advantage. Two naphtha upgrading process flow schemes are evaluated in this report. Low pressure reforming of the FBR naphtha is compared to a split-naphtha scheme where light and heavy naphtha is processed separately, so as to maximize yield. 9 refs., 21 figs., 22 tabs.

48079 (DOE/PC/91257–T6) **Molten-caustic-leaching (Gravimelt) system integration project: Quarterly report, January–March 1990.** TRW Space and Technology Group, Redondo Beach, CA (USA). Applied Technology Div. 29 Mar 1990. 3p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-86PC91257. Order Number DE90017892. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

TRW, under the sponsorship of the Department of Energy's Pittsburgh Energy Technology Center is evaluating the Gravimelt or MCL Process in commercial equipment installed in an Integrated Test Circuit. Operation of the Gravimelt test circuit for desulfurization and demineralization of coal was completed last year when a 48-test process matrix was performed over 750 hours of operational time resulting in the production of 3,000 pounds of treated coal suitable for further test and evaluation. The results are briefly discussed.

48080 (MIC–90-03612/XAB) **Methods for producing liquid hydrocarbons from coal.** Alberta Energy and Natural Resources, Edmonton, AB (Canada). Scientific and Engineering Services and Research Div. ©1990. 21p. Source: NTIS, PC EE07/MF E01.

Summaries of research projects for producing liquid hydrocarbon from coal. Projects include a description of the initial coal liquefaction studies; results from a 2-kg continuous-flow bench-scale liquefaction unit used to liquify Highvale and Vesta coals in a dispersed-catalyst process involving various catalysts and single- or two-stage processing; supercritical gas extraction of coal using a lignite from Saskatchewan and a high-volatile bituminous coal from Alberta; the liquefaction of coal with natural gas; and coal conversion waste water treatment.

48081 (PB–90-252578/XAB) **Catalysis of carbon gasification: Influence of different modes of addition of catalysts. Annual report, January 1989–January 1990.** Richards, G.N. Montana Univ., Missoula, MT (USA). Wood Chemistry Lab. May 1990. 70p. Contract GRI-5088-260-1639. Source: NTIS, PC A04/MF A01.

See also PB–89-188833.

Two major studies have been completed. The first deals with potassium-catalyzed, and the second with copper-catalyzed gasification of chars by air. The potassium catalysis showed a normal fall in gasification rate with increasing HTT for chars prepared up to ca. 650C, followed by a dramatic increase in gasification rate with HTT above the temperature. The extent of the phenomenon was dependent on the mode of addition of catalyst. The possible changes in chemical nature of the catalyst with HTT are discussed on this basis. The efficiency of copper-catalysis was dependent on the extent of crystallization of elemental copper in the char and both aspects were strongly dependent on the mode of incorporation of catalyst. The copper-catalyzed chars exhibited a dramatic jump. All of the chars exhibited a dramatic jump in reactivity with increasing gasification temperatures, e.g. the initial rate of gasification may increase 350 fold for 5C temperature increase. The jump is accompanied by a transition from a high activation energy region to a low activation energy region with increasing temperature. The causes of these effects are discussed.

48082 **High pressure NMR spectroscopy studies: The regioselective hydrogenation mechanism of polynuclear heteroaromatic nitrogen compounds with $Cp^*Rh(CH_3CN)_3^{2+}$ as a catalyst precursor.** Baralt, E. (Univ. of California, Berkeley (USA)); Fish, R.H.; Kastrup, R.V.; Horvath, I.T. pp. 108, Paper INOR 375 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

The regioselective hydrogenation mechanism of quinoline and other polynuclear heteroaromatic nitrogen model coal compounds in the presence of $[Cp^*Rh(CH_3CN)_3]X_2$ (X = $[BF_4]_2$ or $[PF_6]_2$) as a catalyst precursor in CD_2Cl_2 at probe temperature (30°C) was studied by high pressure NMR spectroscopy (HPNMR). The hydrogenation reaction was monitored for 23h and the following observations were made and will be discussed: Selective H/D exchange of protons at the 2 and 8 positions of quinoline; hydrogenation of the C=N and C=C bonds occur selective; η^6-coordination (benzene ring) of the regioselective hydrogenation product, 1,2,3,4-tetrahydroquinoline (THQ), to Cp^*Rh^{2+}; ligand exchange of quinoline for complexed THQ to continue the catalytic cycle.

0106 Properties and Composition

Refer also to citation(s) 48094, 48210, 48211, 49065, 49066, 49771

48083 (DOE/PC/79919–13) **Flotation and flocculation chemistry of coal and oxidized coals: Technical progress report, March 15, 1990–June 14, 1990.** Somasundaran, P. Columbia Univ., New York, NY (USA). Henry Krumb School of Mines. [1990]. 26p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87PC79919. Order Number DE90017879. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A thermodynamic approach was used to study the heterogeneity of the coal surface wherein the heat of adsorption of methanol on coal was obtained by two different techniques viz. calorimetry and gas adsorption. A gravimetric apparatus was used to generate isotherms of methanol vapor on coal at two different temperatures. Analysis of the isosteric heat of adsorption obtained by this method for this system provided a qualitative picture of the surface sites distribution on coal. It appears that the more hydrophobic sites on the coal surface are located in a dense manner such that the adsorbed molecules on these sites are in a highly condensed state. The relatively hydrophilic sites are probably more spatially spread out such that adsorbed molecules on these sites are less condensed than the liquid state implying some degree of mobility of the adsorbed layer. Integral heat of adsorption curves for the methanol-coal system obtained from the heat of immersion data of coal and coal with various degrees of precoverage of methanol in methanol are presented. A double differentiation of this curve provides a quantitative measure of the heterogeneity of the coal surface in terms of the site distribution function. 17 refs., 8 figs.

48084 (DOE/PC/79925–7) **Chemical characterization of the surface sites of coal: Technical progress report, April–June 1989.** Fowkes, F.M.; Riddle, F.L. Jr.; Cole, D.A. Lehigh Univ., Bethlehem, PA (USA). Dept. of Chemistry. Aug 1990. 10p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87PC79925. Order Number DE90017888. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We propose to do experimental studies in four related areas concerning the acid-base properties of coal surfaces: develop high precision flow microcalorimetric methods for determining the concentrations and strengths of the acidic and basic surface sites of coal powders; develop photo-acoustic FTIR and solid-state NMR spectral shift techniques for determination of the concentrations and strengths of acidic and basic surface sites of coal powders; determine the concentrations and strengths of the acidic and basic surface sites of some coal samples from Argonne National Labs., comparing the coal samples before and after demineralization treatments with HCl and HF; and study the effects of surface acidity and basicity on the coal/water interface. A practical application of the new measurements of the reactions of surface sites will be to determine the acid-base contributions to adsorption of ions and of surfactants from aqueous media onto coal. Work this quarter was concentrated on the measurement of the acidity of polyvinyls by the NMR chemical shift technique using two ^{31}P calibrated bases. 3 tabs.

48085 (DOE/PC/79925–11) **Chemical characterization of the surface sites of coal: Technical progress report, April–June 1990.** Fowkes, F.M.; Lloyd, T.B.; Cole, D.A. Lehigh Univ., Bethlehem, PA (USA). Dept. of Chemistry. Aug 1990. 17p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87PC79925. Order Number DE91000005. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We propose to do experimental studies in four related areas concerning the acid-base properties of coal surfaces; (1) develop high precision flow microcalorimetric methods for determining the concentrations and strengths of the acidic and basic surface sites of coal powders; (2) develop photo-acoustic FTIR and solid-state NMR spectral shift techniques for determination of the concentrations and strengths of acidic and basic surface sites of coal powders; (3) determine the concentrations and strengths of the acidic and basic surface sites of some of the well-characterized coal samples from Argonne National Labs, comparing the coal samples before and after demineralization treatments with HCl and HF; (4) study the effects of surface acidity and basicity on the coal/water interface, with emphasis on the role of interfacial acid-base interactions in the adsorption of ions, surfactants and coal/water slurry stabilizers. A practical application of the new measurements of the acidity and basicity of surface sites will be to exploit acid-base contributions to preferential wettability for optimizing separation of coal pyrites from the organic components. Work this quarter concentrated on flow microcalorimetry for assessing acidity/basicity of coal powders. 8 refs., 9 figs., 1 tab.

48086 (DOE/PC/88923–T2) **^{31}P NMR analysis of coal moieties bearing -OH, -NH and -SH functions: Quarterly report, April 1, 1990–June 30, 1990.** Verkade, J.G. Iowa State Univ. of Science and Technology, Ames, IA (USA). Dept. of Chemistry. [1990]. 7p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-88PC88923. Order Number DE90017893. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Research on coal analysis continued. Since the last quarterly report we have expanded our two research strategies to include a 31p NMR-active heteroatom tagging event. Our results utilizing this agent, ^{119}Sn, and ^{195}Pt are discussed. 4 refs., 1 tab.

48087 (IS–5009) **Microcharacterization of coal components for beneficiation: Fossil energy quarterly report, April 1, 1989–June 30, 1989.** Straszheim, W.E.; Markuszewski, R. Ames Lab., IA (USA). Sep 1989. 13p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-7405-ENG-82. Order Number DE90017732. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Our studies on the characterization of coal-mineral association by scanning electron microscopy-based automated image analysis (SEM-AIA) have proceeded with the development of an expression for the amount of the phases present on the particle surface which could be used to predict coal behavior in surface-based cleaning processes such as froth flotation. Tables were prepared for two different coals showing the mass of coal and various minerals present in particles with a given fraction of mineral matter on the surface. Such tables may help to predict and/or explain the behavior of coals undergoing surface-based beneficiation. These tables were compared to tables showing the distribution of mass version the fraction of mineral matter in the particle. Major differences were seen in the distribution of mineral matter between the two modes of expression. AIA results were also compared to results of lab-scale float-sink and froth flotation tests. Although a direct comparison of AIA results to cleaning results is not possible, AIA results showed significant differences between the two coals were born out by differences in their cleaning behavior. 4 refs., 10 figs., 2 tabs.

48088 (IS-M–629) **Measurement and control of coal hydrophobicity.** Drzymala, J. (Ames Lab., IA (USA)); Wheelock, T.D. Iowa State Univ. of Science and Technology, Ames, IA (USA). [1989]. 6p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-7405-ENG-82. (CONF-8903173–2: Annual technical conference on filtration and separation, Pittsburgh, PA (USA), 27-29 Mar 1989). Order Number DE90016707. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Hydrophobicity is a surface property which can influence the filtration and dewatering characteristics of a particulate material. Hydrophobic materials resist wetting, and water does not spread spontaneously on the surface of such materials but instead collects in beads or droplets on the surface. The hydrophobicity of coal is known to vary widely with coal rank and the state of surface oxidation of the material. In this discussion, the role which hydrophobicity plays in coal dewatering is reviewed. Also reviewed are methods for measuring, controlling, and possibly predicting this important property. 15 refs.

48089 (IS-M–649) **Insights on pyritic sulfur in coal from image analysis.** Straszheim, W.E. Ames Lab., IA (USA). [1989]. 10p. Sponsored by U.S. DOE Fossil Energy; U.S. Department of the Interior. DOE Contract W-7405-ENG-82. (CONF-891130–5: 3. international conference on processing and utilization of high-sulphur coals, Ames, IA (USA), 14-18 Nov 1989). Order Number DE90018017. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Scanning electron microscopy based automated image analysis (AIA) was used to determine the character of pyrite in coal as it relates to coal beneficiation. Two insights are presented. First, errors previously encountered in SEM-AIA of pyrite were found to stem

from the brightness of pyrite in conjunction with significant porosity in large particles of coal-derived pyrite. Although problematic for analysis, such porosity likely increases the reactivity of the pyrite during subsequent processing. Second, image analysis was used to quantify the amount of residual pyrite following the ASTM-prescribed nitric acid leaching procedure for the determination of sulfur forms in coal. AIA found measurable amounts of pyrite in residues from both hot and cold nitric acid leaching, but found significantly more pyrite in the sample that had been leached with the cold nitric acid. Pyrite constituted up to 15% of the mineral matter in the residues from the cold acid leaching. This suggests that hot nitric acid leaching should be used for reliable determination of pyritic sulfur in coal. 11 refs., 4 tabs.

48090 X-ray absorption spectroscopic study of vanadium sites in fossil fuels and model compounds. Wong, J. (Lawrence Livermore National Lab., CA (USA)); Droege, M.W.; Reynolds, J.G. pp. 33, Paper INOR 109 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

The technique of high resolution x-ray absorption spectroscopy (XAS) using high intensity synchrotron radiation as a light source in both the near-edge region (XANES) and extended fine structure region (EXAFS) to study the bonding and local atomic structure of a given constituent element in a material will be reviewed. The spectra of selected vanadium compounds of known chemical structure and their application to model the trace vanadium sites in coal, petroleum crude oils and their extracts will be presented.

0108 Waste Management

Refer also to citation(s) 48108, 48486, 48499, 48500, 48502, 48503, 48504, 48505, 48506, 48507, 48508, 48509, 48510, 48511, 48512, 48513, 48514, 49555

48091 (CONF-900631–4) **Hazardous waste characterization of solid wastes generated from clean coal technologies.** Peters, R.W.; Wentz, C.A. Argonne National Lab., IL (USA). [1990]. 38p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract W-31109-ENG-38. From International conference on pollution prevention: clean technologies and clean products–the environmental challenge of the 1990's; Washington, DC (USA); 10-13 Jun 1990. Order Number DE90017679. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

With the development of more sophisticated clean coal technologies, highly efficient, environmentally clean, coal-based energy processes have increased the number of options available to reduce emissions from coal-fired power plants. The US Department of Energy (DOE) has been pursuing the development and demonstration of technologies that result in more efficient and effective emission controls. The paper summarizes the available data of the hazardous characteristics of the solid wastes generated from various clean coal technologies, including coal gasification, coal liquefaction, underground coal gasification, fluidized bed combustion, flue gas desulfurization, and magnetohydrodynamics. The available data indicate that the majority of the solid wastes generated using these technologies would not be classified as being hazardous under the current Resource Conservation and Recovery Act (RCRA) standards. 32 refs., 3 figs., 12 tabs.

48092 (DOE/MC/10637–2803, pp. 25, Paper 14) **Advanced wastewater treatment.** Mayer, G.G. (Univ. of North Dakota, Grand Forks (USA)); Gallagher, J.R. North Dakota Univ., Grand Forks, ND (USA). Energy and Mineral Research Center. [1989]. In *Low-rank coal research. Quarterly report, October 1988–December 1988.* Order Number DE90014270. Source: NTIS, PC A22/MF A01.

The overall goal of this research project is to expand the scientific and engineering data base with respect to wastewater treatment for synthetic fuels plants. Specific goals are as follows: (1) develop a novel method for combined carbon oxidation and nitrogen removal, (2) develop a high rate biological oxidation reactor, and (3) define potential pretreatment requirements for discharge of synthetic fuels wastewaters to publicly owned treatment works (POTWs). Goal number one was accomplished through the use of a pilot scale research unit, a downflow coupled fluidized bed system, which combines removal of carbonaceous compounds and nitrogen in wastewater from the Great Plains Gasification Plant. Pretreatment requirements for synfuel wastewaters were evaluated via literature search, evaluation of applicable statutes and a case study. A pilot scale deep column unit is being used for the second project goal. This reactor makes use of pure oxygen, high transfer efficiencies and plug flow kinetics to perform as a high rate biological reactor.

48093 (DOE/PC/90514–T10) **Anaerobic fluid-bed treatment of coal conversion wastewater: Tenth quarterly technical progress report, November 15, 1988–February 15, 1988.** Suidan, M.T.; Pfeffer, J.T.; Nakhla, G.F.; Traegner, U.K. Illinois Univ., Urbana, IL (USA). Dept. of Civil Engineering. [1988]. 14p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC90514. Order Number DE90017875. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Anaerobic fluidized-bed GAC reactors have been proven successful for the treatment of biologically inhibiting wastewaters such as coal conversion wastewaters. Adsorption on granular activated carbon (GAC) represents a viable strategy for the removal of these inhibitory compounds. Partial replacement of the carbon bed is then necessary to maintain the concentration of inhibitory compounds below threshold levels. The cost of the GAC replacement thus represents a major operating cost of the system. Objectives of this research are to determine, using experimental and modeling strategies, the effects of hydraulic detention time and the schedule of GAC replacement on the performance of fluidized bed GAC anaerobic reactors during the treatment of coal conversion wastewater. This objective is realized by the following activities: (a) Operation of two expanded-bed GAC anaerobic reactors at empty-bed hydraulic detention times of 1.0 and 0.5 days. Wastewater includes phenol, acetic acid and o-cresol as model compounds of a real coal conversion wastewater. (b) Development of a mathematical model. (c) The calibrated model will be used to analyze a vast volume of experimental data on the treatment of coal gasification wastewater and refinery sour water stripper bottoms. 1 ref., 4 figs., 2 tabs.

48094 (IS-M–625) **Experimental studies of the production of lightweight aggregate from fly ash/coal cleaning refuse mixtures.** Burnet, G.; Gokhale, A.J. Ames Lab., IA (USA). [1987]. 17p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-7405-ENG-82. (CONF-8710519–1: 12. international symposium on coal ash utilization, Washington, DC (USA), 28-31 Oct 1987). Order Number DE90017426. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this work, a granulation/sintering process have been developed for the manufacture of lightweight aggregate from coal cleaning refuse and fly ash. The resulting granules have the properties required of a lightweight aggregate. It is important to note, however, that while these properties can be measured and evaluated, it is difficult to identify a good aggregate other than by showing that it can be used to make good concrete. Tests on the aggregate alone are helpful in assessing its suitability, but the final criterion must be performance in concrete. This evaluation remains to be done for the refuse/fly ash aggregate. 7 refs., 5 figs., 4 tabs.

48095 (IS-M–628) **The stabilization and utilization of coal solid wastes.** Burnet, G. (Iowa State Univ. of Science and Technology, Ames, IA (USA). Dept. of Chemical Engineering). Iowa State Univ. of Science and Technology, Ames, IA (USA). [1988]. 13p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-7405-ENG-82. (CONF-8810523–1: B. F. Ruth memorial symposium, Ames, IA (USA), 12 Oct 1988). Order Number DE90016706. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

One of the most important technical issues of the 1980's is the effective and economical disposal or utilization of solid wastes. Solid waste utilization or resource recovery is the preferred option for coal solid waste management, but disposal remains the dominant practice. Work on waste management has achieved improved problem definition and the conceptualization of processes, some of which are ready for commercial evaluation. Processes developed at the Ames Laboratory are the granulation/sintering method for the codisposal of coal cleaning and coal combustion-related wastes and the lime-soda sinter process and HiChlor process for mineral

and byproduct recovery from the wastes. The stabilization method yields an environmentally benign material and sulfur as a byproduct. The lime-soda sinter process consumes the entire fly ash yielding metallurgical-grade Al_2O_3 and a partially burned portland cement. The HiChlor process permits the recovery of the major as well as the minor elements present in the ash. Cost will be the final determining factor as to the merit of these processes and will require at least pilot plant scale investigation. 12 refs., 9 figs.

48096 (KFK–4716) **On the removal of mercury from flue-gas scrub solutions by cementation.** Volkman, Y. Kernforschungszentrum Karlsruhe GmbH (Germany, F.R.). Lab. fuer Isotopentechnik. Apr 1990. 29p. Order Number DE90519796. Source: NTIS (US Sales Only), PC A03/MF A01.

1. The cementation of mercury as means for its removal from flue-gas scrub solutions has been tested in lab-scale. The experimental results have been used for the preliminary design of an industrial cementation reactor applying scrap iron shavings. 2. The results indicate that there is a lower limit (of about 0,35 mg/l) to the residual mercury concentration in the treated solution. This concentration is higher than the maximal permissible concentration for disposal (0.05 ppm). It complies, however, with the pre-treatment requirements for the 3R-process. High parasitic dissolution of iron indicate evolution of large quantities of hydrogen. 3. The design parameters of the cementation reactor complicate the mechanical requirements set by the need to replenish continuously the iron shavings hold-up in the reactor. 4. The cementation route for the removal of mercury from the flue-gas scrub solutions has therefore been found to be less attractive than expected. (orig.).

0109 Environmental Aspects

Refer also to citation(s) 48103, 48515, 48734, 49051, 49418, 49420, 49427, 49428, 49434, 49444, 49447, 49448, 49451, 49452, 49454, 49465, 49467, 49600

48097 (CONF-900801–29) **An integrated acid precipitation policy and energy market model.** Boyd, G.; Fox, J.; Hanson, D. Argonne National Lab., IL (USA). [1990]. 6p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From 25. intersociety energy conversion engineering conference; Reno, NV (USA); 12-17 Aug 1990. Order Number DE90017673. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The use of disparate and detailed engineering and economic models is often necessary for environmental policy analysis and forecasting. However, to conduct consistent forecasting and policy analysis over all economic sectors these models must be coordinated into a consistent model set. One approach is the NAPAP Integrated Model Set, a collection of engineering, emissions-forecasting, and energy-market models that is driven by and interacts with other energy-market and economic models. 11 refs., 2 figs.

48098 (MIC–90-03267/XAB) **Plains hydrology and reclamation project: Spoil ground-water chemistry and its impacts on surface water.** Trudell, M.R. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. ©1988. 154p. Source: NTIS, PC EE12/MF E01.

Description of the chemical makeup of spoil groundwater at Diplomat and Vesta mines in the Battle River mining area, 200 km southeast of Edmonton within the Lower Horseshoe Canyon coal zone; and at Highvale and Whitewood Mines in the Lake Wabamun mining area, 100 km west of Edmonton within the Ardley coal zone. This report compares the chemical characteristics of the spoil groundwater for each mine to those of the principal premining aquifer that is disrupted by surface mining. The characterization of spoil groundwater chemistry is based on the sampling and analyses of groundwater from piezometers installed in reclaimed areas. Forty-three samples were collected from 23 piezometers at Vesta Mine, and 54 samples were collected from 32 piezometers at Diplomat Mine. At Highvale Mine, 29 samples were collected from 13 piezometers installed in the reclaimed area at Pit 01. Eleven samples were also collected from piezometers installed in spoil at Whitewood Mine to augment a study of that site.

48099 (MIC–90-03279/XAB) **Report and recommendations regarding the environmental-assessment report for the proposed Point Aconi electrical generating station.** KML Co., Munich (Germany, F.R.). ©1990. 121p. Source: NTIS, PC EE12/MF E01.

The Nova Scotia Power Corp. (NSPC) announced plans to build a 165 MW generating station at Point Aconi, on Boularderie Island, Cape Breton, based on a requirement for new generating capacity. NSPC proposes to construct a unit using circulating fluidized bed (CFB) combustion technology. The unit will have turbine generators, coal and limestone storage and handling facilities, an ash management area, a well field to supply fresh water and a circulating water system. A review panel was authorized by the Council and held a hearing January 17, 1990. This report presents the review panel's recommendations, background information and the mandate of the Council, public consultation measures, and concerns expressed. These concerns included legislation, alternatives, fuel and sorbent management, liquid waste management, fresh water supply, circulating water system, air quality, general construction practices, community concerns, and the formation of a local monitoring committee. Also included are the terms of reference for the environmental assessment report, an executive summary, and a list of submissions.

0110 Reserves, Geology, and Exploration

48100 (MIC–90-03392/XAB) **Geotechnical study of rock-mass classification parameters for Sydney coal field, Nova Scotia.** Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). ©1989. 128p. Contract CANMET-89002-01-SQ. Source: NTIS, PC EE12/MF E01.

Fold. maps not filmed.

Review of the Norwegian Geotechnical Institute Q system, the CSIR geomechanics classification system and the RSR system. Parametric and back-analysis were undertaken to establish ranges of values appropriate for use with these rock mass classification systems in the coal measure strata of the Sydney coalfield. The classification systems were modified to reflect the results of the back-analyses and were then applied to characterize the rock mass at selected existing and future mining areas in Donkin Mine, Lingan Mine, Prince Mine and Phalen Mine.

0120 Mining

Refer also to citation(s) 49737

48101 (MIC–90-03377/XAB) **Tracer gas used for the mine-fire simulations. Report No. CRL 89-87(TR).** Klinowski, G.W.; Kennedy, D.J. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). ©1989. 36p. Source: NTIS, PC EE07/MF E01.

Over the past 7 years, the Cape Breton Coal Research Laboratory has designed, built, tested and proved the necessary hardware, software and methodology of tracer gas based surveying techniques for mine gas ventilation. Tracer gas based ventilation techniques can be and were used in many problematic situations where the standard ventilation methods are inadequate, such as the emergency imposed by a mine fire. During the fire simulation exercise, tracer gas release systems emulating the fire are positioned in sensitive locations within the mine. The tracer gas concentrations in air samples collected in strategic points of the mine indicate their contamination levels. Simulations undertaken at the Orchard Valley Mine were planned to assert the integrity of so-called smoke-free roadway and to gain knowledge of the smoke distribution patterns in the event of fires erupting in 2 different locations within the mine. The performance, portability and flexibility of the equipment was also tested.

48102 (MIC–90-03380/XAB) **Review and evaluation of main roadway intersection techniques for use in the Sydney coal field.** Golder Associates, Mississauga, ON (Canada). ©1988. 217p. Contract CANMET-79019-01-SQ. Source: NTIS, PC EE17/MF E01.

Fold. maps not filmed.

Review of the support design and practice for main roadway intersections in the U.K., the U.S., Canada, South Africa and Australia; review and evaluation of the existing designs and rock conditions for roadway intersections in the Sydney coalfield, with particular reference to the Lingan Mine; and consideration for applying alternative intersection design methods to the Sydney coalfield.

48103 (PB-90-252420/XAB) **Alluvial valley floor identification and study guidelines. Final report.** Earth Resources Associates, Helena, MT (USA). 25 Jan 1983. 265p. Contract J5120056. Source: NTIS, PC A12/MF A02.

See also PB-90-153081.

The handbook reviews regulatory and technical aspects of alluvial valley floors, an important issue to coal mining in the semiarid and arid parts of the western United States. The information contained in the handbook should be helpful to the coal mine operator, interested citizen, regulatory agency, and land management agency in identifying, studying, and predicting impacts to alluvial valley floors. In developing the handbook, the Office of Surface Mining used the experience gained by this office and the states in dealing with alluvial valley floors since passage of the Surface Mining Control and Reclamation Act of 1977. The handbook uses this experience to guide the reader toward certain study approaches. However, it is emphasized that the handbook is solely an advisory document and the only fixed requirements relating to alluvial valley floors are contained in the statute itself or adopted regulations.

0130 Transport, Handling, and Storage

Refer also to citation(s) 48087, 48210, 48211

48104 (IS-M-644) **Coal handleability: Addressing the concerns of the electric utility industry.** Arnold, B.J. (Electric Power Research Inst., Homer City, PA (USA). Coal Quality Development Center); Harrison, C.D.; Lohnes, R.A. Ames Lab., IA (USA). [1989]. 22p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-7405-ENG-82. (CONF-890238-6: Annual meeting and exhibit of the Society of Mining Engineers, Inc., Las Vegas, NV (USA), 27 Feb - 2 mar 1989). Order Number DE90018039. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Over 600 million tons of coal are handled annually for use by the country's coal-fired power plants. Coal is transported in various ways: overland conveyors, railcars, trucks, and barges. It can travel short distances or thousands of miles, picking up moisture, freezing, or drying. When the coal is received at the power plant, environmental problems with fugitive dust and further handling problems can arise. This report discusses utility coal handling concerns. The program has identified key areas of concern, and has begun to investigate the cost and cause of and the solutions to coal handling problems. The ultimate goal of the program is to develop a "handleability index" for utilities to use in their coal specifications or hardware for a utility's sampling system to predict handleability and determine if a coal shipment should be accepted. 17 refs., 5 figs., 3 tabs.

0140 Combustion

Refer also to citation(s) 48194, 48199, 48890, 48891, 49549, 49550, 49551, 49552, 49554, 49556

48105 (CONF-900546-14) **Corrosion behavior of materials in FBC [fluidized-bed combustion] environments.** Natesan, K. Argonne National Lab., IL (USA). Apr 1990. 14p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From 4. conference on fossil energy materials; Oak Ridge, TN (USA); 15-17 May 1990. Order Number DE90017865. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Oxidation-sulfidation interactions that lead to accelerated metal wastage of components can occur in fluidized-bed combustion (FBC) systems, owing to the presence of sorbent deposits on metal surfaces and/or the low oxygen partial pressures in the exposure environment. Laboratory tests were conducted to examine the influence of deposit and gas chemistry and alloy pretreatment on corrosion of high-chromium alloys such as Incoloy 800 and Type 310 stainless steel. Detailed chemical and physical analyses that were conducted on spent-bed materials were correlated with the observed corrosion behavior of the alloys. The influence of bubbling- and circulating-bed deposits on the corrosion of several candidate alloys was comparatively analyzed. 6 refs., 8 figs.

48106 (CONF-900801-33) **Effects of jet port arrangement on three-dimensional non-reacting jet -gas mixing in an MHD second stage combustor.** Lottes, S.A.; Chang, S.L.; Berry, G.F. Argonne National Lab., IL (USA). [1990]. 6p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From 25. intersociety energy conversion engineering conference; Reno, NV (USA); 12-17 Aug 1990. Order Number DE90017858. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A three-dimensional hydrodynamics computer code was used to investigate the flow mixing processes in an MHD second stage combustor. The code solves the conservation equations of mass, momentum, energy, and a transport equation of turbulence kinetic energy. The flow mixing patterns of four different jet port arrangements, including a 12-jet, an 8-center-jet, an 8-side-jet, and an 8-mixed-jet (4 side and 4 center jets), were computed and compared. Jet and gas seems to mix in two stages: an early and more effective convective stage and a later diffusive stage. For the same bulk jet concentration, the 12-jet arrangement has better jet-gas mixing than the other three 8-jet arrangements. 8 refs., 8 figs.

48107 (CONF-9006105-12) **Three-dimensional computer simulation of non-reacting jet-gas flow mixing in an MHD second stage combustor.** Chang, S.L.; Lottes, S.A.; Berry, G.F. Argonne National Lab., IL (USA). [1990]. 9p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From 28. symposium on engineering aspects of magnetohydrodynamics; Chicago, IL (USA); 26-28 Jun 1990. Order Number DE90017831. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Argonne National Laboratory is investigating the non-reacting jet-gas mixing patterns in a MHD second stage combustor by using a three-dimensional single-phase hydrodynamics computer program. The computer simulation is intended to enhance the understanding of flow and mixing patterns in the combustor, which in turn may improve downstream MHD channel performance. The code is used to examine the three-dimensional effects of the side walls and the distributed jet flows on the non-reacting jet-gas mixing patterns. The code solves the conservation equations of mass, momentum, and energy, and a transport equation of a turbulence parameter and allows permeable surfaces to be specified for any computational cell. 11 refs., 16 figs.

48108 (DOE/MC/24207-2857) **Reaction kinetics of the CaO-SO_2 system in absence of inter-grain pore diffusion: Annual report.** Kono, H. West Virginia Univ., Morgantown, WV (USA). Dept. of Chemical Engineering. Apr 1990. 17p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC21-87MC24207. Order Number DE90009672. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Effective removal of SO_2 released due to the combustion of coal is of primary concern and of vital importance in fluidized bed combustion technology. Utilization of limestone, as a sorbent in FBC, to remove SO_x is an attractive and promising technique. However, the incomplete utilization of limestone causes an increase in limestone usage and bed spent materials. In order to improve the limestone utilization, one must understand the fundamental rate-limiting step and particle deactivation mechanism during CaO-SO_2 reaction. The aim of this work is to better understand the CaO-SO_2 reaction, particularly in terms of its intrinsic kinetics, rate-limiting steps, and particle deactivation mechanisms. The proposed approach involves the reaction of a single flat-plate CaO crystal with SO_2 in a thermogravimetric analyzer. Appropriate experimental equipment was installed and the methodology to derive the related parameters has been established. Based on the mathematical model as reported in this report, the effect of diffusion rate, chemical reaction rate and reaction time on the reaction conversion were preliminarily obtained numerically and experimentally. Thus, the reliable experimental data of the gas diffusion coefficient in the product layer of $CaSO_4$ has been obtained for the first time in open literature. 13 refs., 4 figs., 1 tab.

48109 (DOE/MC/24207–2858) **Deposition, corrosion, erosion and sulfur emission studies related to coal combustion: Annual report.** Celik, I.; Shahnam, M.; Katragadda, S.; Usmen, R. West Virginia Univ., Morgantown, WV (USA). Dept. of Mechanical and Aerospace Engineering. Apr 1990. 92p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC21-87MC24207. Order Number DE90009671. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The direct use of pulverized coal in combustion applications, although an economically attractive technology, is limited at present by certain environmental and surface-degradation problems. Incombustible, inorganic constituents of coal deposit as submicron, and supermicron sized particles on relatively cool heat exchanger surfaces. In addition, sulfur in the coal is released in the form of sulfur dioxide and trioxide vapors during combustion. These 'barrier issues' need to be addressed at the fundamental level before coal can be considered a viable, competitive fuel. The deposition and corrosion problems are particularly important in the direct-fired gas turbine technology which is still in a stage of development. In order to better understand and control the complex problem of deposition, it is necessary first to accurately define the environment in which the combustion of coal particles take place. The global objective of this research was to provide experimental and theoretical frame work with which different coals combusting in different environments can be evaluated for their fouling potential and that deposition control strategies can be formulated. Therefore, the following tasks were undertaken: (1) development of and testing of a particle – temperature measurement technique via four-color pyrometry (2) analysis of the flow and temperature field of an entrained flow reactor which would be used for combustion-deposition studies of pulverized coal particles (3) development and testing of a gas-temperature measurement technique using a Fourier transformed – infrared (FT-IR) spectrometer in high temperature gas streams. Results are discussed. 51 refs., 36 figs., 4 tabs.

48110 (DOE/METC–89/6108-Vol.2, pp. 641-644) **Artificial Intelligence in process control.** Lawson, L.O.; Hensel, J.P.; Thornton, J.D.; Solheim, B.; Henry, D.M. USDOE Morgantown Energy Technology Center, WV (USA); USDOE Pittsburgh Energy Technology Center, PA (USA). Oct 1989. (CONF-891046–: Advanced research and technology development, Morgantown, WV (USA), 3-5 Oct 1989). In *Proceedings of the advanced research and technology development direct utilization, instrumentation and diagnostics contractors review meeting. Volume 2.* Order Number DE90000425. Source: NTIS, PC A16/MF A01.

The objective of this work is to investigate Artificial Intelligence (AI), expert system techniques and advanced microprocessors for enhanced control of research processes. The knowledge traditionally applied by the process engineer in tuning the parameters of a control system can be applied to perform real-time process simulation and control. The speed of the transputer microprocessors being used in this study should provide control tuning capabilities unachievable by manual techniques. In a specific application, an expert system was developed for tuning the proportional and integral control parameters of a particle position feedback control system for an electrodynamic balance. This process is nonlinear in response to the controlled variable, and thus, a linear mathematical solution of the control parameters is intractable. This process and the associated control loop are also too fast to be properly tuned by manual adjustment of the control gains. These problems are overcome, however, by using real-time process simulation. A Particle Dynamic Model (PDM) is performed in real-time by a transputer that computes a match between the PDM response and the observed particle response. A combined simulation of this model and the control system is then performed. The expert system runs concurrently with this simulation and tunes the control parameters to satisfy the control stability criterion. The expert system rule base is the set of criterion defined by the control engineer to determine proper control stability, overshoot, and settling time. Once an agreeable tuning condition has been met, the control parameters are passed on to the working control system. Application demonstrates the utility of expert system techniques in process control situations. Expert systems may provide a means of transferring operating expertise gained from small scale experimental studies to large scale or commercial processes. 6 figs.

48111 (DOE/PC/89769–T2) **Computer modeling of a CFB [circulating fluidized bed] gasifier: Third technical progress report.** Gidaspow, D.; Ding, J. Illinois Inst. of Tech., Chicago, IL (USA). Dept. of Chemical Engineering. Jun 1990. 54p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-89PC89769. Order Number DE90017877. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The overall objective of this investigation is to develop experimentally verified models for circulating fluidized bed (CFB) combustors. This report presents an extension of our cold flow modeling of a CFB given in our first quarterly report of this project and published in "Numerical Methods for Multiphase Flows" edited by I. Celik, D. Hughes, C. T. Crowe and D. Lankford, FED-Vol.91, American Society of Mechanical Engineering, pp47–56 (1990). The title of the paper is "Multiphase Navier-Stokes Equation Solver" by D. Gidaspow, J. Ding and U.K. Jayaswal. To the two dimensional code described in the above paper we added the energy equations and the conservation of species equations to describe a synthesis gas from char producer. Under the simulation conditions the injected oxygen reacted near the inlet. The solid-gas mixing was sufficiently rapid that no undesirable hot spots were produced. This simulation illustrates the code's capability to model CFB reactors. 15 refs., 20 figs.

48112 (DOE/PC/90505–T5) **Mechanisms of surface enrichment and adhesion of coal combustion particulates: Sixth and seventh quarterly reports, December 16, 1987–June 15, 1988.** Shadman, F.; Peterson, T.W.; Wendt, J.O.L.; Rizeq, R.G. Arizona Univ., Tucson, AZ (USA). Dept. of Chemical Engineering. [1988]. 47p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC90505. Order Number DE90017891. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this phase of the project, the study of alkali metal vapor interactions with selected additives in a laboratory scale downflow combustor was performed. This study was accomplished by conducting experiments in which a rapidly mixed gas flame was doped with sodium or potassium and allowed to interact with additives injected in-situ in the furnace environment. Particle samples collected from various experimental conditions were analyzed using scanning Auger microscopy to characterize their surfaces for alkali adsorption. Results identified three mechanisms for scavenging alkali vapors from combustion gases using aluminosilicate additive compounds. These were alkali capture by reaction/adsorption, by surface condensation on additive particles, and by alkali nucleation and coagulation with additive particles. These mechanisms would occur independently or simultaneously depending on the temperature profile along the furnace, on the initial alkali concentration in the gas phase, and on the additive rate of supply to the furnace. 3 refs., 11 figs., 7 tabs.

48113 (DOE/PC/90505–T6) **Mechanisms of surface enrichment and adhesion of coal combustion particulates: Eighth and ninth quarterly reports, June 16, 1988–December 15, 1988.** Shadman, F.; Peterson, T.W.; Wendt, J.O.L.; Uberoi, M. Arizona Univ., Tucson, AZ (USA). Dept. of Chemical Engineering. [1988]. 32p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC90505. Order Number DE90017890. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

High temperature interactions of metal vapors with solids are important in processes like coal conversion, waste incineration, chemical vapor deposition and chemical vapor infiltration. In this study, the interactions of alkali vapors with porous aluminosilicate solids are investigated. This system exhibits many general features of interactions of metal vapors with porous solids. In general, depending on the metal vapor concentration, two sorption mechanism are possible: (a) Direct reaction of metal vapor with the solid. (b) Condensation in the pores of the solid and subsequent reaction of condensate with the solid. The important kinetic parameters for both mechanisms are determined. The apparent activation energy for reaction of condensed alkali with solid was found to be lower than that for the vapor-solid reaction. A theoretical model has been developed to simulate the processes of surface condensation, pore condensation and chemical reaction occurring during interactions of saturated metal vapors with porous solids. The model predictions are in good agreement with experimental data. 18 refs., 12 figs.

48114 (IS-M-647) **Heat transfer in a two-bed fluidized combustor.** Foley, J.E. (Iowa State Univ. of Science and Technology, Ames, IA (USA). Dept. of Mechanical Engineering); Brown, R.C.; Buttermore, W. Iowa State Univ. of Science and Technology, Ames, IA (USA). Engineering Research Inst. Mar 1989. 9p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-7405-ENG-82. (ERI-89282;CONF-890819-29: ASME/AIChE national heat transfer conference, Philadelphia, PA (USA), 6-9 Aug 1989). Order Number DE90018015. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objective of this study is to improve load turndown in a bubbling fluidized combustor by using a two-bed design. The combustor consists of a central bed, which supports combustion of coal, and a surrounding annular bed, which controls heat transfer from the central bed. Load turndowns up to 12.4 were achieved while burning three different fuel forms: crushed coal, coal-limestone briquettes, and coal-water-limestone mixture (CWLM). 5 figs., 2 tabs.

48115 (IS-M-648) **A resistance wire technique applied to heat transfer measurements in high aspect ratio fluidized beds.** Pflum, D.L. (Iowa State Univ. of Science and Technology, Ames, IA (USA). Dept. of Mechanical Engineering); Brown, R.C.; Maxwell, G.M. Iowa State Univ. of Science and Technology, Ames, IA (USA). Engineering Research Inst. Mar 1989. 8p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-7405-ENG-82. (ERI-89279;CONF-890819-30: ASME/AIChE national heat transfer conference, Philadelphia, PA (USA), 6-9 Aug 1989). Order Number DE90018016. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The purpose of this investigation is to determine convection coefficients in high aspect ratio fluidized beds. High aspect beds, which have recently been used to improve load turndown in fluidized bed combustors, are under consideration for immersion cooling of electronic equipment. Bed-to-wall convection coefficients are obtained by using a heated-wire technique. Resistance wire is wound around the wall and the wall is immersed in a fluidized bed. Convection coefficients are determined by plotting power dissipated in the bed versus the temperature of the resistance wire. Two systematic errors are inherent to this heated-wire technique: temperature gradients between wires and heat conduction through the wall. These systematic errors can be corrected by using a finite-difference numerical model of the wire-wrapped surface. The purpose of this paper is to demonstrate how we can correct these systematic errors while retaining the usefulness of the technique for heat transfer measurements in fluidized beds. 8 refs., 6 figs., 2 tabs.

48116 (IS-M-650) **Load turndown in a two-bed fluidized combustor.** Brown, R.C.; Foley, J.E.; Buttermore, W. Ames Lab., IA (USA). Oct 1988. 18p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-7405-ENG-82. (CONF-890402-11: 10. international conference on fluidized-bed combustion, San Francisco, CA (USA), 30 Apr - 3 may 1989). Order Number DE90018022. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objective of this research is to investigate a new concept in fluidized bed design that improves load turndown capability. This design consists of a central combustion bed surrounded by an annular fluidized bed that establishes overall heat-transfer rate from the combustion bed. We have constructed a laboratory-scale version of this two-bed combustor and are testing its performance when burning three fuel forms of Illinois No. 5 coal: 3/8 inch x 8 mesh crushed coal, coal-water-limestone mixtures, and coal-limestone briquettes. In tests with crushed coal, we have achieved a load turndown of 12.3. These experimental results compare favorably with predictions of a computer model that simulates heat transfer in the combustor. 5 refs., 7 figs., 1 tab.

48117 (LBL-26455, pp. 187) **Studies of materials erosion in coal conversion and utilization systems.** Levy, A.V. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The erosion and erosion-corrosion studies have been primarily directed toward the problem of metal wastage of heat transfer tubes in fluidized bed combustors (FBCs), of both bubbling and circulating types. Cooperation with major US boiler manufacturers has presented the opportunity to use bed material erodents from a number of operating FBCs that have a range of chemical and physical characteristics to determine how their variations relate to metal wastage in both laboratory and in-service exposures. The operation of laboratory erosion-corrosion test equipment to simulate the conditions in FBCs necessitated the determination of how test variables such as particle size and solids loading affected material wastage at lower particle velocities and temperatures than had been used in previous work. Based upon observations of how scales form on steels being eroded-corroded, low Cr content steel alloys were formulated with somewhat higher than normal silicon contents that demonstrated marked reductions in metal wastage. Ongoing and future research will continue in the direction of understanding how and why real materials behave as they do in simulated and real FBC environments. Increased cooperative efforts with industry are planned.

48118 (LBL-26455, pp. 187) **Behavior of tubing steels in FBC in-service testing.** Geng, G.Q. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The metal wastage rates and mechanisms of superheater tubes in the convection pass region of commercial circulating fluidized bed combustors (CFBCs) were determined by the analysis of 2 1/4Cr-1Mo steel tubes from a CFBC secondary superheater and 1,018 steel tubes from a cooler location in the primary superheater of the same CFBC. It was determined that the basic metal wastage mechanism was the formation of an outer scale layer of mixed bed material and iron oxide that was eroded away in a brittle manner by the cracking and chipping of a segmented scale. In order to determine the relative metal wastage behavior of four candidate FBC heat exchanger tubing alloys with increasing chromium for the primary and secondary superheaters of the convection pass of a circulating fluidized bed combustor, flat specimens 2 in long x 0.14 in. thick were tack welded directly onto the tops (α = 90°) and sides (α = 30°) of superheater tube shields in an operating CFBC. One group of 20 specimens was exposed for 950 hours and another for 1,885 hours. After exposure the metal wastage was measured and microscopic observations of the specimens' surfaces and cross sections were made. It was found that the metal wastage decreased with increasing chromium content of the alloys no matter which location the specimens occupied in the convection pass region, how long they were exposed, or how high the exposure temperature was.

48119 (LBL-26455, pp. 187-188) **The erosion-corrosion of modified chromium steels.** Wang, B.Q. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Low alloy steels containing 2-9% chromium and other alloying elements with either regular silicon or additional silicon content were tested at the velocities and temperatures that can occur in AFBCs, i.e., low velocity (10 m/s and 20 m/s) and low elevated temperatures (450°C, 650°C) using CFBC bed material as the erodent. It was determined that the particular characteristics of the scale that formed on each of the alloys affected the metal wastage that occurred. The low chromium content (2-3%) steels that contained additional silicon (1.4-1.5 wt%) had markedly lower metal loss than regular silicon content steels with the same or even higher chromium content. At the lower temperature and particle velocity, a thicker mixed bed material-iron oxide protective scale layer formed on the surface of the additional silicon steel compared to the normal silicon steel than at the higher particle temperature and velocity. Metallographic analysis of tested specimens showed that the metal wastage caused by erosion-corrosion of the normal silicon content steels occurred by higher loss rate spalling of the weaker scale during the test.

48120 (LBL-26455, pp. 188-189) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

An investigation was carried out to determine what kinds of metal loss rates and mechanisms occurred when the various types of particles in AFBCs were used as erodents in a laboratory blast nozzle type tester. Sixteen different particles were obtained from

10 different combustors; they included bed material, sand, limestone, and precipitator ash. Tests were carried out at conditions that nearly simulated those in AFBCs. It was determined that several characteristics of the particles contributed to the metal wastage that occurred. Among them were composition, shape, size, and strength. The erosion of mixed bed material-iron oxide scales that formed on the target metal surfaces was the primary mechanism of metal wastage. The effects of several particle variables on the erosivity of gas-solid particle streams were determined. They included shape, mass, size, impact velocity, and feed rate. Tests were carried out at room temperature on 1,018 steel using spherical shape glass beads and angular shape SiC, neither of which shattered upon impact. The range of the test variables, particularly the particle velocities, used in the investigation were considerably different from those reported in the literature. It was determined that there was a major difference in the erosivity of the spherical and angular shaped particles as a function of particle size. The shape of particles was a major factor in determining their erosivity, angular particles generally being an order of magnitude more erosive than spherical particles.

48121 (PB–90-247230/XAB) **Co-firing of natural gas and coal. Annual report, October 1988-September 1989.** Peters, J.E.; Buckius, R.O.; Krier, H. Illinois Univ., Urbana, IL (USA). Dept. of Mechanical and Industrial Engineering. Jan 1990. 34p. Contract GRI-5088-260-1767. Source: NTIS, PC A03/MF A01.

In the program fundamental studies of combined natural gas and coal combustion were initiated using a Drop Tube Furnace Facility (DTFF) which was designed and built for single coal particle studies. Coal particles are injected into the DTFF which simulates the environment of a coal furnace but with control over key parameters including gas temperatures (1200 to 1700 K), residence times (5 msec to 2 sec), gas species concentrations (CH4, O2, CO2, etc.) and heating rates (up to 10,000 K/sec). Diagnostics used to study the combustion behavior of the coal particles include a two-color pyrometer for particle temperature measurements, a digital camera and computer imaging analysis system for in situ particle size and morphology determination, and a solids sampling system for ash collection and analysis. With the DTFF and these diagnostics the combustion of coal particles is studied with particular emphasis on the effects of natural gas addition on ignition delay, char burnout, sulfur retention in the ash, particle burning rate and particle morphology during combustion. Preliminary results show decreased ignition delay and significant changes in particle morphology with natural gas addition.

0160 Health and Safety

48122 (CRIE-U–89036) **Biological effects of combined exposure to coal fly ash and nitrogen dioxide. 3.: Morphological changes in respiratory organs of golden hamster.** Negishi, T.; Nishimura, I. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Nov 1989. 53p. (In Japanese). Order Number DE91701407. Source: NTIS (US Sales Only), PC A04/MF A01.

The morphological changes in respiratory organs of golden hamster due to the combined exposure to coal fly ash (FA) and nitrogen dioxide (NO_2), was studied. The changes in trachea and alvroli epithelia cells by short-term combined exposure were mainly caused by NO_2, no synergistic influence of FA was found. When animals were exposed to short-term combined exposure to 4ppm of NO_2, the residence time of alveolar macrophages (AM) was shortened, and the discharge of FA partcles was accelerated. After long-term combined exposure, particle-laden AM in alveoli clustered more frequentry than those in FA-group did. This suggests that long-term exposure to FA and 4ppm NO_2 damaged AM and airway epithelial cells, and the activity of AM was lowered. On the other hand, after long-term exposure to 0.4ppm of NO_2 and FA, respiratory tracts and AM showed few pathological changes. From these results, the combined influence of FA and NO_2 in current ambient level can be almost disregarded. 40 refs., 21 figs., 4 tabs.

48123 (MIC–90-03381/XAB) **Determination of the levels of dinitropyrenes on diesel-exhaust particulate exhibiting excess mutagenic activity.** Westaway, K.C. Laurentian Univ., Sudbury, ON (Canada). ©1989. 34p. Contract CANMET-79133-01-SS. Source: NTIS, PC EE07/MF E01.

High volume samples of diesel exhaust particulate were collected downstream from 2 different Deutz 714 series diesels fitted with Dieseler III catalytic converters in an underground mine. The samples were collected on a level underground site with an 800 foot tramming distance to the ore pass. The diesel exhaust extracts collected were tested on Salmonella bacteria used in the Ames bioassay. This report presents the results of the work.

02 PETROLEUM

Refer also to citation(s) 48192

0202 Reserves, Geology, and Exploration

Refer also to citation(s) 49375, 49376, 49735

48124 (AD-A–222910/2/XAB) **Geologic interpretation of gravity anomalies.** Andreyev, B.A.; Klushin, I.G. Foreign Technology Div., Wright-Patterson AFB, OH (USA). 19 Apr 1990. 902p. (FTD-ID(RS)T–0202-88). Source: NTIS, PC A99/MF E06.

Partially edited machine trans. of mono. Geologicheskoye Istolkovaniye Gravitatsionnykh Anomaliy, Leningrad, 1965, 1-495.

This Russian textbook provides a sufficiently complete and systematic illumination of physico-geologic and mathematical aspect of complex problem of interpretation of gravity anomalies. The rational methods of localization of anomalies are examined in detail. All methods of interpreting gravity anomalies are described which have found successful application in practice. Also given are ideas of some new methods of the interpretation of gravity anomalies, the prospects for further development and industrial testing. Numerous practical examples to interpretation are given. Partial Contents: Bases of gravitational field theory; Physico-geologic bases of gravitational prospecting; Principles of geologic interpretation of gravity anomalies; Conversions and calculations of anomalies; Interpretation of gravity anomalies for bodies of correct geometric form and for bodies of arbitrary form; Geologic interpretation of the results of regional gravitational photographing; Searches and prospecting of oil- and gas-bearing structures and of deposits of ore and nonmetalliferous useful minerals.

48125 (DOE/EIA–0534) **US oil and gas reserves by year of field discovery.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 20 Aug 1990. 137p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE90017657. Source: NTIS, PC A07/MF A01 - GPO - OSTI; GPO Dep.

This publication is the first in a series of periodic Energy Information Administration (EIA) statistical reports presenting supplemental information about the Nation's reserves of crude oil and natural gas. This report, US Oil and Gas Reserves by Year of Field Discovery, illustrates the development and depletion of US crude oil and natural gas resources over the entire history of the industry. These national, state, and area listings are expected to provide unique and valuable information to energy resource analysts in Federal and State Governments, industry, the academic community, and to others involved in the study of oil and gas occurrence. Comprehensive information of this type was last published by the American Petroleum Institute and the American Gas Association in June 1980. 26 figs., 22 tabs.

48126 (GSC–90-1F, pp. 87-93) **Petroleum source rock characteristics of the Tertiary Skonun Formation, Queen Charlotte Islands, Hecate Strait and Queen Charlotte Sound, British Columbia.** Bustin, R.M. (Dept. of Geological Sciences, Univ. of British Columbia, Vancouver, BC (Canada)); Vellutini, D.; Goodarzi, F. Geological Survey of Canada, Ottawa, ON (Canada). 1990. (MICROLOG–90-03552). In *Current research, part F. Frontier Geoscience Program. Cordilleran and offshore basins, British Columbia.* Source: PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth

St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The Neogene Skonum Formation comprises more than 4500 m of nonmarine and transitional marine strata. On Graham Island the formation is mainly mature with respect to oil generation, whereas in Hecate Strait and Queen Charlotte Sound, the formation varies from immature to overmature. The source rock potential of the strata is probably poor to moderate. In general, the organic matter is gas prone Type II or Type III with low hydrogen and production indices. Locally, there are intervals with Type I or Type II organic matter, with hydrogen indices up to 450 mg hydrocarbons/g total organic carbon, production indices up to 1.0 and with quality of organic matter values up to 6 mg hydrocarbons/g rock. There is no apparent stratigraphic or lateral variation in source rock quality. In general, total organic carbon contents are higher on Graham Island and on northern Hecate Strait than in Queen Charlotte Sound. 9 refs., 8 figs.

48127 (GSC–90-1F, pp. 121-127) **Stratigraphy, organic maturation, and source rock potential of Cretaceous strata in the Chilcotin-Nechako region (Nazko Basin), British Columbia.** Hunt, J.A. (Dept. of Geological Sciences, Univ. of British Columbia, Vancouver, BC (Canada)); Bustin, R.M. Geological Survey of Canada, Ottawa, ON (Canada). 1990. (MICROLOG–90-03552). In *Current research, part F. Frontier Geoscience Program. Cordilleran and offshore basins, British Columbia.* Source: PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

In the Chilcotin-Nechako region a highly varied succession of marine, transitional marine, and nonmarine, coarse to fine grained clastic rocks outcrop. These strata define two basins: the Jurassic Nechako basin and the Cretaceous Nazko Basin. The Nechako Basin is defined by rocks of the Ashman Formation of the Bowser Lake Goup. The Nazko Basin includes rocks of the Skeena, Relay Mountain, Jackass Mountain, Taylor Creek, and Kingsvale groups and the Kitsun Creek Formation. Marine Cretaceous rocks occur throughout the Chilcotin-Nechako region, suggesting that the Cretaceous Nazko Basin may have extended from Smithers to the Methow Basin. The lateral extent of the Nechako Basin was probably similar to that of the Nazko Basin, extending from the Skeena Arch to the Tyaughton Trough. Preliminary studies indicate that the level of organic maturation and petroleum source rock quality is highly variable within the Chilcotin-Nechako region. 6 refs., 5 figs.

48128 (GSC–90-1F, pp. 115-120) **A new Frontier Geoscience Project: Chilcotin-Nechako region, central British Columbia.** Hickson, C.J. Geological Survey of Canada, Ottawa, ON (Canada). 1990. (MICROLOG–90-03552). In *Current research, part F. Frontier Geoscience Program. Cordilleran and offshore basins, British Columbia.* Source: PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Data from exploration wells in the Chilcotin-Nechako region have indicated potential source and reservoir rocks but exploration interest has declined because the basic geological data and concepts of basin evolution and architecture are insufficient to pursue the work. A research project has been undertaken to provide some of the missing data and to permit assessment of the hydrocarbon potential of this region. The Chilcotin-Nechako region is underlain by the Stikine and Cadwallader terranes. Stikine rocks are thought to be the most extensive, but Jurassic (Toarcian) fossils found near Chilcotin River suggest that the Cadwallader Terrane extends northward beyond the Tyaughton-Methow Basin. The region experienced Late Jurassic emergence followed by an Early to mid-Cretaceous marine transgression. Black shale was found southeast of Tatla Lake, confirming the areal extent of the marine transgression. Late Cretaceous-early Tertiary emergence was followed by Eocene extension producing restricted, internally drained basins with nonmarine sediments and coal. The Mesozoic and Tertiary strata contain possible hydrocarbon source rocks. 17 refs., 3 figs.

48129 (GSC–90-1F, pp. 103-108) **Stratigraphy, sedimentology and petroleum source rock potential of the Georgia Basin, southwest British Columbia and northwest Washington State.** Bustin, R.M. (Dept. of Geological Sciences, Univ. of British Columbia, Vancouver, BC (Canada)). Geological Survey of Canada, Ottawa, ON (Canada). 1990. (MICROLOG–90-03552). In *Current research, part F. Frontier Geoscience Program. Cordilleran and offshore basins, British Columbia.* Source: PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Upper Cretaceous and Tertiary strata along the eastern margin of Georgia Basin include nonmarine and transitional marine clastic rocks and coal. The succession thickens from the erosional edge at the northern margin, to 670 m at Abbotsford to >4400 m at Point Roberts. Surface and subsurface stratigraphy cannot be readily correlated by lithology. Level of organic maturation of strata along the basins margin is highly variable (0.3 - >2% mean radom vitrinite reflectance). Subsurface strata are immature to mature with respect to oil generation. Maturation inexplicably does not appear to increase with depth of burial. The strata have moderate to poor petroleum source rock characteristics. They contain mainly gas prone Types II and III organic matter with hydrogen indices generally >300 mg hydrocarbons/g total organic carbon. The highly variable total organic carbon contents correlate with the presence or absence of discrete carbonaceous partings and coal. 16 refs., 5 figs.

48130 (MIC–90-03187/XAB) **Geology of the Stoney Creek oil and gas field, and its implications regarding the tectonic evolution of the eastern Moncton subbasin, New Brunswick. Geoscience report No. 89-1.** New Brunswick Dept. of Natural Resources and Energy, Fredericton, NB (Canada). Minerals and Energy Div. ©1989. 91p. Source: NTIS, PC EE07/MF E01.

The Stoney Creek oil and gas field is situated 16 km south of Moncton, New Brunswick, on the west side of the Petitcodiac River. This report describes the results of a detailed study of the sedimentology, facies relationships and geological setting of the Albert Formation with the Stoney Creek oil and gas field. The well cuttings of 31 strategically located wells were relogged in detail and the data used in conjunction with existing lithological well data to establish a computer supported subsurface model for the field. The geological data gathered were used to interpret the geotectonic evolution of the eastern part of the Moncton subbasin and the Sackville subbasin. The data are summarized in an interpretive model describing the regional controls on the reservoir geology.

48131 (ST–89-18) **Alberta's reserves of crude oil, oil sands, gas, natural gas liquids, and sulphur.** Energy Resources Conservation Board, Calgary, AB (Canada). 1988. vp. (CE–03142). Source: Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4. Prices: $80.00 CAN.

This report presents tables of data on reserves of conventional crude oil, bitumen, synthetic crude oil, natural gas, natural gas liquids, sulfur, and ethane in Alberta. Other information provided includes reservoir and formation characteristics, energy content (for gas), and historical statistics on wells and additions to reserves. Estimates of the ultimate potential of reserves are also presented. A folded map in pocket illustrates oil and gas fields, oil sand deposits, main pipelines, refineries and gas processing plants. Includes glossary.

0203 Drilling and Production

Refer also to citation(s) 48200

48132 (MIC–90-03501/XAB) **Bacterial evaluation of the biopolymer selective plugging field test at Standard Hill, Saskatchewan.** Stehmeier, L. Nova Husky Research Corp. Ltd. (Canada). ©1988. 240p. Contract CANMET-79066-01-SQ. Source: NTIS, PC EE17/MF E01.

A field test of a biopolymer selective plugging system was carried out by Husky Oil Ltd. in the Standard Hill field, Saskatchewan.

This field has a history of wells watering out in a sequential southwest pattern, indicating an encroaching aquifer. Radioactive tracers identified the entrance point of this aquifer and the plugging system was injected at this point to inhibit the water influx. This report covers the injection of sacrificial agent in the field, preparation of bacterial inoculum, injection of bacteria inoculum and polymer medium, and post-injection microbial analyses.

48133 (ST–89-17) **Alberta oil and gas industry annual statistics, 1988.** Energy Resources Conservation Board, Calgary, AB (Canada). May 1989. 87p. (CE–03141). Source: Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4. Prices: $20.00 CAN.

This report presents tabulated data on Alberta's petroleum and natural gas activity for 1988. Included are supply and disposition statistics (and in some cases inventory and price figures) for crude oil and equivalent, gas, raw material and fuel, refined products, ethan, propane, butanes, natural gas liquid mixes, and sulphur. An historical overview from 1979 to 1988 is presented for the same categories of statistics. Well counts and drilling activity for 1988 and 1979-1988 are also summarized. 18 figs., 23 tabs.

48134 **Foams for effective gas blockage in the presence of crude oil.** Hanssen, J.E.; Dalland, M. pp. 209-222 of SPE/DOE seventh symposium on enhanced oil recovery: Proceedings. EOR [enhanced oil recovery] in the 1990's: Global prospects and perspectives. Society of Petroleum Engineers, Richardson, TX (US) (1990). (CONF-900426–: 7. SPE/DOE symposium on enhanced oil recovery, Tulsa, OK (USA), 22-25 Apr 1990).

A study of foams for possible application in a new process with a potential for improving production from thin oil rims by formation of effective barriers against gas coning is reported. A total of 48 foaming agents for aqueous and non-aqueous systems have been evaluated using a gas-blockage test, as well as bulk foam stability tests and measurements of relevant surfactant properties. All experiments were performed in contact with sea water and crude oil at elevated temperature. In the gas-blockage test, foam is generated in 2-m long, 8.5-μm^2 bead packs by constant-pressure displacement of a surfactant solution by gas at residual oil saturation. Stabilized gas rates through the foam-filled glass-bead pack are subsequently measured as a function of stepwise increasing pressure gradients. Only 4 foams were found capable of reducing gas permeability to the order of 0.1 μm^2 or lower, at pressure gradients of 1 to 5 bar/m. These four products were found to be effective also in long-term tests at a constant pressure gradient of 1.5 bar/m. A number of foams known to be efficient gas-blocking agents in oil-free media were non-blocking in presence of residual oil. Bulk stability could not predict the gas-blocking ability for the foams studied. Further, no correlation was found between foam gas-blocking ability and the interfacial tensions, spreading conditions, oil saturation, foam quality, surfactant oil solubilization, or relative wetting abilities of surfactants measured. The four successful products found are fluorinated surfactants, from three different manufacturers, and were effective at 0.5 to 1 wt% concentration. Several fluorinated surfactants failed the gas-blockage test.

48135 **A semianalytical thermal model for linear steamdrive.** Gajdica, R.J. (ARCO Oil and Gas Co., Bakersfield, CA (USA)); Brigham, W.E.; Aziz, K. pp. 259-274 of SPE/DOE seventh symposium on enhanced oil recovery: Proceedings. EOR [enhanced oil recovery] in the 1990's: Global prospects and perspectives. Society of Petroleum Engineers, Richardson, TX (US) (1990). (CONF-900426–: 7. SPE/DOE symposium on enhanced oil recovery, Tulsa, OK (USA), 22-25 Apr 1990).

The purpose of this work is to develop an analytical model that produces results close to thermal simulator results. A semianalytical model (SAM) has been developed for one-dimensional linear systems and two-dimensional linear cross-sectional systems. Wells are located at both ends of the reservoir. At the injection well, wet steam is injected at a constant rate and enthalpy. The production well produces at a constant flowing bottomhole pressure. The SAM includes formation dip; and compressibilities and thermal expansion of the formation, water, and oil. The model automatically calculates the steam zone steam saturation, the water front location and overburden heat losses. The two-dimensional model also includes gravity override of steam. The system of equations is solved by iteration. In the process, front locations, temperatures, pressures, and phase saturations are determined for each of the zones. Oil and water production rates are calculated by material balance. In the two-dimensional model, a new empirical method is presented which determines the shape of the steam front, and an extension of an existing waterflooding correlation is used to determine the volumetric sweep efficiency. Many cases were run on both the SAM and the Computer Modeling Group's general purpose thermal simulator ISCOM for comparison. The SAM was several orders of magnitude faster than the thermal simulator, yet it produced accurate matches of thermal simulator results. The computer program can be easily run on a personal computer. A computer floppy disk is available that contains FORTRAN programs of the model, and sample data files. Files listing the results are also included. The disk is available through the Petroleum Engineering Department at Stanford University.

48136 **Evaluation of unrecovered mobile oil in Texas, Oklahoma, and New Mexico.** Becker, A.B.; Brashear, J.P.; Biglarbigi, K.; Ray, R.M. pp. 791-800 of SPE/DOE seventh symposium on enhanced oil recovery: Proceedings. EOR [enhanced oil recovery] in the 1990's: Global prospects and perspectives. Society of Petroleum Engineers, Richardson, TX (US) (1990). (CONF-900426–: 7. SPE/DOE symposium on enhanced oil recovery, Tulsa, OK (USA), 22-25 Apr 1990).

This paper summarizes the technical findings of a regional assessment of oil recovery potential through advanced primary and secondary processes for reservoirs in Texas, Oklahoma, and New Mexico. Intensive infill drilling, polymer-augmented waterflooding, permeability profile modification and selected combinations of these processes show significant promise for increasing recovery and sweep efficiencies in certain geologic reservoir settings. Given the current technical development and costs of these processes, their application could be feasible in a wide range of reservoirs in the region analyzed, even at oil prices below $20/Bbl. These advanced recovery techniques are all directed at producing unrecovered mobile oil (UMO), which is displaceable by waterflooding but remains in the reservoir at the conclusion of conventional production due to reservoir heterogeneity and unfavorable mobility differences between water and oil. The analysis, which was sponsored by the Department of Energy's Bartlesville Project Office and Office of Planning and Environment, evaluates nearly 500 reservoirs described in the data base. The data base, process predictive models, and analytical methodology used in the study are described in this paper. In addition important case study results and comparisons to published results for key reservoirs and other detailed analyses are discussed. The results indicate that UMO extraction has significant future potential to increase oil reserves and maintain domestic production. This potential is large even at low to moderate oil prices and utilizing existing technology. However, the key to maximizing UMO recovery is the development and wide-scale application of advanced techniques resulting from focused research and development (R and D).

0204 Processing

Refer also to citation(s) 48076, 48077, 48145, 48195, 49071

48137 (EUR–12235) **Selective steam cracking for energy and raw materials savings: Final report.** Broutin, P. (Groupement Europeen de Recherches Technologiques sur les Hydrocarbures (GERTH), 92 - Rueil-Malmaison (France)); Busson, C. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation; Groupement Europeen de Recherches Technologiques sur les Hydrocarbures (GERTH), 92 - Rueil-Malmaison (France); Ghent Rijksuniversiteit (Belgium). Lab. voor Petrochemische Techniek. 1989. 15p. Sponsored by Commission of the European Communities. Contract EN3E-0043-F(CD). Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg.

This project was proposed to study a new steam cracking technology using ceramic reactor with high ratio surface/volume which allows high temperature level and high heat flux. Studies carried out on the INSTITUT FRANCAIS DU PETROLE micropilot, and by

Professor in FROMENT in GENT showed the interest of high heat flux and specially of a square temperature profile which ensures and olefins selectivity increase. First experiments on the ceramic pilot confirmed that the studied technology allows such a profile and consequently high olefins yields. If life of such reactors is proved to be sufficient, this technology could be soon used in industrial plants. 3 refs., 5 figs., 4 tabs.

48138 An overview of hydrodesulfurization (HDS), hydrodenitrification (HDN), and hydrodemetalation (HDM) in petroleum chemistry. Reynolds, J.G. (Lawrence Livermore National Laboratory, CA (USA)). pp. 32, Paper INOR 108 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). DOE Contract W-7405-ENG-48. (CONF-900402--: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

HDS, HDN, and HDM are crucial to the conversion of crude oils to transportation fuels. Although oil company refineries accomplish these types of processes on a commercial basis, much still remains to be learned about the technology. This presentation will summarize what is known about chemistry and the problems of HDS, HDN, and HDM on a commercial level. It will also address some of the areas where future contributions to the understanding of the chemistry can be very useful (particularly modeling).

0205 Products and By-Products

Refer also to citation(s) 48828

0207 Economic, Industrial, and Business Aspects

Refer also to citation(s) 48145, 48698, 48748, 49470

48139 (CERI-34) **World oil market projections, 1990-2005.** Reinsch, A.E.; O'Reilly, M.A. Canadian Energy Research Inst., Calgary, AB (Canada). Mar 1990. 198p. (MICROLOG-90-03744). Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

This report is the second in a series of research studies designed to monitor developments in the world oil market, to assess the likely impact of key uncertainties affecting the market, and to provide a reference crude oil price path upon which industry and government can base their investment decisions and policy prescriptions. The projections are the product of the Canadian Energy Research Institute world oil market model, an integrated supply-demand model capable of generating consistent projections of world oil prices or OPEC production levels under a wide range of plausible assumptions for world economic growth, product demand response to oil price and income changes, ultimate potential oil reserves in the non-OPEC producing countries and other critical variables. The study suggests that the fragility of oil prices is likely to dissipate throughout the 1990s, with slow but steady growth for refined petroleum products combined with a gradual decline in non-OPEC productions serving to tighten the supply-demand balance in the world oil market. Placed against the supply-demand fundamentals are such new uncertainties as actions on behalf of the global environment directed toward the reduction of atmospheric and greenhouse gas emissions. The efforts of the developing countries toward industrialization and economic growth are a continuing source of energy and petroleum products demand. In addition, the social changes in the Soviet Union and Eastern Europe could have major impacts on world energy markets, through both increased demand and greater exploitation of the hydrocarbon reserves in those regions. Reference cases are included for regional oil products demand, regional supply projections, and gross domestic product forecast. A glossary is included. 22 figs., 53 tabs. 78 refs.

48140 (CERI-90-01036, pp. 1-10, Paper 5) **Kuwait Petroleum Corporation: New horizons for national oil companies.** Hussain, H.A. (Kuwait Petroleum Corp. (Kuwait)). Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344--: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG-90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

The Kuwait Petroleum Corporation (KPC) was formed in 1980 as part of the movement to state control over the production of oil in the exporting countries. KPC was conceived as a fully integrated oil company encompassing all facets of oil operations. It serves as an umbrella corporation compassing public companies which specialize in, for example, exploration, refining, transportation or petrochemicals. The new structure allows for diversification into new geographic areas and new product lines. This paper provides an overview of the background, operating strategy and international operations of KPC, including its expansion into downstream marketing in Europe, supplying more than 250,000 B/D in 7 European countries. KPC also introduced a new brand, Q8, for its downstream operations worldwide. Future developments include participation in developed world markets and in markets in the developing world. 1 fig.

48141 (MIC-90-03744/XAB) **World oil market projections, 1990-2005. Study No. 34.** Reinsch, A.E.; O'Reilly, M.A. Canadian Energy Research Inst., Calgary, AB (Canada). ©1990. 198p. Source: NTISMF E01.

Microfiche only.

The global energy market responded to the uncertainty of world oil supply and prices through the pursuit of increased energy efficiency and multiple energy sourcing. The evolution of the world oil market and the likely path of crude oil prices continue to play a key role in shaping domestic energy policy and energy sector planning. This report is the 2nd in a series of research studies designed to monitor developments in the world oil market, to assess the likely impact of key uncertainties affecting the market, and to provide a reference crude oil price path upon which industry and government can base their investment decisions and policy prescriptions. The centrepiece of the research effort is the CERI world oil market model, an integrated supply-demand model capable of generating consistent projections of world oil prices or OPEC production levels under a wide range of plausible assumptions regarding world economic growth, product demand response to oil price and income changes, and ultimate potential oil reserves in the non-OPEC oil producing countries.

48142 (OIES-EE-7) **An econometric analysis of exploration and extraction of oil on the U.K. continental shelf.** Hashem Pesaran, M. (Trinity College, Cambridge (GB)). Oxford Institute for Energy Studies (UK). Mar 1989. 51p. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

An econometric framework for the analysis of exploration and production policies of "price-taking" suppliers is developed, and theoretically-consistent exploration and output equations for oil which explicitly take account of the oil discovery process and the intertemporal nature of exploration and production decisions are derived. The framework is then applied to an empirical analysis of oil exploration and extraction on the United Kingdom Continental Shelf (UKCS). The analysis differs from the other econometric studies in the field in a number of respects: the output and exploration equations estimated in the paper are theory-consistent in the sense that they are both derived as solutions to a single optimization problem. Careful attention is paid to the problem of expectations formation and presents formal tests of the hypothesis that oil price expectations are formed rationally against the alternatives that they are formed adaptively or recursively are presented. (author).

48143 (PMA-90-02942) **Canadian petroleum industry: 1989 monitoring report. First six months.** Petroleum Monitoring Agency, Ottawa, ON (Canada). 1989. 103p. (MICROLOG-90-02942). Source: PC Petroleum Monitoring Agency, 580 Booth St., Ottawa, ON, CAN K1A 0E4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This report describes the financial performance of the oil and gas industry in Canada during the first 6 months of 1989. The report is based on data from 127 companies accounting for 90% of

total revenues of the petroleum industry. The report lists noteworthy happenings in the industry, gives highlights of the 6-month period, then details financial performance, sources and uses of funds, comparative performance with other industries, international flows of funds compared to the previous year, capital structures compared to the previous year, and gives income tax-related data for the current and previous years. Overall industry cash flow rose 4% as a result of the partial recovery of crude oil prices from 1988 levels. In addition, cash flow improvements reflected higher sales volumes of marketable natural gas, more than offsetting lower prices. 12 figs., 19 tabs.

48144 (SASKOIL–89-05826) **Saskoil annual report 1988.** Saskoil-Saskatchewan Oil and Gas Corp., Regina, SK (Canada). [1988]. 56p. (MICROLOG–89-05826). Source: PC Saskoil, 1000 Grenfell Tower, 1945 Hamilton St., PO Box 1550, Regina, SK, CAN S4P 3C4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

Saskoil is a publicly traded oil and gas company in Saskatchewan with productive properties located in that province and in Alberta. This document presents a review of the year's activities, with production-related statistics and financial statements included. Highlights of 1988 include production of 21.1 billion cubic feet of natural gas and 6.4 million bbl of oil; acquisition of natural gas reserves to reach a total of 928 billion cubic feet, almost 10 times the 1987 figure; an agreement with a heavy oil upgrader in Regina to purchase 7,500 bbl/d of heavy crude; an addition of 8 million bbl of oil to the reserves through implementation of waterfloods in selected reservoirs; drilling of 293 gross wells, or 72% above 1987 levels; and lower selling prices both for crude oil and natural gas which severely impacted on Saskoil's ability to report financial results in line with the substantial production gains made during the year. 14 figs., 22 tabs.

0208 Waste Management

48145 (EUR–12097) **Catalytic hydrotreatment of refinery waste: Demonstration project: Final report.** Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation; Groupement Europeen de Recherches Technologiques sur les Hydrocarbures (GERTH), 92 - Rueil-Malmaison (France). 1989. 21p. Sponsored by Commission of the European Communities. Contract BM025/85/FR. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 5.

The object of this project and report is to produce liquid hydrocarbons by the catalytic hydroprocessing of solid refinery wastes (hard pitches) in order to improve the profitability of deep conversion processes and reduce the excess production of heavy fuels. The project was mostly carried out on the ASVAHL demonstration platform site, at Solaize, and hard pitches were produced primarily by deasphalting of atmospheric or vacuum distillation residues. The project includes two experimental phases and an economic evaluation study phase. In Phase 1, two granular catalysts were used to transform pitch into standard low sulfur fuel oil: a continuously moving bed, with demetallation and conversion catalyst; a fixed bed, with hydrorefining catalyst. In Phase 2 of the project, it was proven that a hydrotreatment process using a finely dispersed catalyst in the feedstock, can, under realistic operating conditions, transform with good yields hard pitch into distillates that can be refined through standard methods. In Phase 3 of the project, it was shown that the economics of such processes are tightly linked to the price differential between"white" and "black" oil products, which is expected to increase in the future. Furthermore, the evolution of environmental constraints will impel the use of such methods, thus avoiding the coproduction of polluting solid residues. 11 figs., 1 tab.

48146 (PB–90-234451/XAB) **Amendment to the best demonstrated available technology (BDAT) background document for wastes from the petroleum refining industry K048, K049, K050, K051, K052. Final report.** Kinch, R.; Vorbach, J. Versar, Inc., Springfield, VA (USA). May 1990. 156p. Contract EPA-68-W9-0068. Source: NTIS, PC A08/MF A01.

See also Volume 17, PB–90-234444 and Volume 19, PB–90-234469. Also available in set of 19 reports PC E99/MF E99, PB–90-234279.

The background document provides the Agency's technical support and rationale for the development of treatment standards for the constituents to be regulated for the above-mentioned wastes. The amendment presents the K048-K052 solvent extraction and incineration data used to develop the treatment standards for nonwastewaters; presents the K048 incinerator scrubber water data used to develop the treatment standards for cyanide in wastewaters; and provides EPA's rationale and technical support for various treatment standards.

48147 (PB–90-234642/XAB) **Final response to BDAT related comments document. K043-K052, K036, K037. Volume 1-O.** Rosengrant, L.; Craig, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 205p. (EPA–530/SW-90/061Q). Source: NTIS, PC A10/MF A02.

See also Volume 1-N, PB–90-234634 and Volume 1-P, PB–90-234659. Also available in set of 19 reports PC E99/MF E99, PB–90-234477.

The contents of this document include the following: petroleum refining industry wastes (basis for bdat selection, bdat treatment standards, variability of wastes used to establish bdat treatment standards, treatment data, and general regulatory comments); organophosphorous wastes (nonwastewaters); and ww treatment sludges from the production of disulfoton.

0209 Environmental Aspects

Refer also to citation(s) 48145, 48169, 48170, 48171, 48183, 48705, 48734, 49585, 49635

48148 (AD-A–223046/4/XAB) **Computation of emissions from exhaust-gas composition measurements.** Meyers, J.; Meyers, M.; Meyers, P. Wisconsin Univ., Madison, WI (USA). Jul 1989. 15p. Contract DAAL03-86-K-0174. Source: NTIS, PC A03/MF A01.

Pub. in Transactions of the ASME, Vol. 111, 410-423(Jul 1989).

This paper presents a calculation technique and related computer program to yield mass emission rates from measured exhaust gas composition and fuel flow rate or fuel plus air flow rate (if air flow rate is measured). The sensitivity of the computed emission rates to the method of calculation and experimental measurement errors is investigated. It is recommended that published emission rates be the average of the rates computed by several different methods, as discussed in this paper, to minimize the effort of experimental the effect of experiment variations in measurement. This, plus use of the computer program presented, would standardize the assumptions used in computing emissions and minimize differences in reported emission rates from different laboratories.

48149 (FWS/OBS–80/23) **A handbook for management of oil and gas activities on lands in Alaska: Petroleum industry practices, environmental impacts and stipulations.** Hamley, P.T. (Dames and Moore, Anchorage, AK (USA)); Hemming, J.E.; Morsell, J.W.; Morehouse, T.A.; Leask, L.E.; Harrison, G.S. Fish and Wildlife Service, Washington, DC (USA). Div. of Biological Services; Dames and Moore, Anchorage, AK (USA); Alaska Univ., Anchorage, AK (USA). Inst. of Social and Economic Research. Aug 1983. 69p. Sponsored by U.S. Department of the Interior. Contract 14-16-009-79-123. Source: OSTI; US Fish and Wildlife Services, Division of Biological Services, US Dept. Of The Interior, Washington, DC 20240.

This handbook presents information in the characteristics of oil and gas activities on lands in Alaska and the environmental effects on such activities. Correct and improper practices are identified for various construction and operation activities. Data requirements for successful management of oil and gas activities with respect to fish and wildlife protection are specified. Environmental protection stipulations for oil and gas exploration and development are presented in the appendices. This handbook is intended to assist US Fish and Wildlife Service personnel, including refuge managers and their staffs, in the protection of fish and wildlife resources and management of oil and gas activities on lands in Alaska. 16 refs., 4 figs., 9 tabs.

48150 (MIC–90-03290/XAB) **Maritime Pollution Claims Fund (Canada): Annual report 1988-1989.** Transport Canada, Ottawa, ON (Canada). ©1990. 9p. (SSC-T –1-8/1989). Source: NTIS, PC EE07/MF E01.

Text in English and French (Bilingual).

Final annual report of the Fund, which will be replaced by the Ship-Source Oil Pollution Fund. The report covers action on the 1988 Grays Harbour, Washington oil spill which contaminated beaches on Vancouver Island; the discharge of oil from a barge near Matane, Quebec in 1986; an unidentified discharge of oil in Lake Superior near Michipicoten, Ontario in 1984; and a discharge of oil at Come by Chance, Newfoundland in 1988. Outstanding claims are described, as are amendments to the Canada Shipping Act which would affect the Fund. A summary of the financial status of the Fund is included.

48151 (MIC–90-03330/XAB) **Draft guidelines for an environmental impact assessment: N.B. Power, Millbank Generating Station.** New Brunswick Electric Power Commission, Fredericton, NB (Canada). ©1990. 26p. Source: NTIS, PC EE07/MF E01.

Text in English and French (Bilingual). French ed. on the same fiche.

Document to identify important environmental issues arising from the proposal by the New Brunswick Electric Power Commission (N.B. Power) to construct and operate a combustion turbine generating station with a nominal capacity of 400 MW (4 x 100 MW turbines) at Millbank, New Brunswick. This proposed facility, which will burn low sulphur diesel oil (0.5%), is expected to operate for approximately 500 hr/yr to provide peaking capacity for both domestic use and for export. The guidelines provide a general framework for conducting an environmental impact assessment. This document gives guidelines on the conduct of the EIA and methods of report preparation. Significant issues are identified as the impact of gaseous emissions from the proposed plant, power transmission impacts, impacts of noise, social impacts, impacts of accidental spills, and impacts of groundwater consumption. Environmentally significant areas are also identified.

48152 (MIC–90-03394/XAB) **Oil-spill preparedness in the upstream petroleum industry.** Canadian Petroleum Association, Calgary, AB (Canada). ©1989. 132p. Source: NTISMF E01.

Microfiche only.

Assessment of the Canadian upstream petroleum industry's current state-of-preparedness for dealing with oil spills resulting from exploration and producing activities. The study uses realistic worst case scenarios to assess the industry's ability to respond to large offshore spills caused by oilwell blow-outs in the Beaufort Sea, Grand Banks, and Scotian Shelf areas during drilling and onshore oil spills from a variety of sources. It does not address future production scenarios in the Beaufort Sea, off the east coast or future exploration activities off the west coast.

48153 (MOC–90-03394) **Oil spill preparedness in the upstream petroleum industry.** Mobil Oil Canada, Calgary, AB (Canada). Nov 1989. 130p. (MICROLOG–90-03394). Source: PC Canadian Petroleum Association, 3800 - 150 6th. Ave. S.W., Calgary, AB, CAN T2P 3Y7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This study assesses the Canadian upstream petroleum industry's current state of preparedness for dealing with oil spills resulting from exploration and production activities. It recommends that between $13 and $15 million be spent on research and development, contingency planning management systems, the creation of an implementation committee by the Canadian Petroleum Association and the Independent Petroleum Association of Canada, equipment acquisition, and training over the next 5 years to prevent and control onshore and offshore oil spills more effectively. The study uses realistic worst case scenarios to assess the industry's ability to respond to large offshore spills caused by oil-well blow-outs in the Beaufort Sea, Grand Banks, and Scotian Shelf areas during drilling, and onshore oil spills from a variety of sources. Changes and improvements to existing remedial measures have been listed and evaluated in view of the need for accelerated implementation and deployment of oil spill containment and prevention systems. In some regions, oil spills from offshore drilling structures or into major rivers during the spring ice breakup period would be exceedingly difficult to contain and recover. These admitted difficulties can only be addressed through preventive measures. Nevertheless, the report highlights the essential need for a continued, even renewed, commitment by senior management of individual corporations to be directly involved in the decision-making process before, during and after spill events. 77 refs., 7 tabs.

48154 (OCS/EIS/EA/MMS–90-0042-Vol.2) **Gulf of Mexico sales 131, 135, and 137: Central, Western, and Eastern planning areas: Final environmental impact statement: Volume 2, Sections IV.D. and IX.** Minerals Management Service, New Orleans, LA (USA). Gulf of Mexico OCS Regional Office. Aug 1990. 811p. Sponsored by U.S. Department of the Interior. Source: OSTI; US Department of Interior, Minerals Management Service, Gulf of Mexico OCS Region, 1201 Elmwood Park Blvd, New Orleans, LA 70923-2394.

This report describes the environmental impacts resulting from the recovery of petroleum and natural gas in the gulf of Mexico. The impacts on water and air quality, habitat, fishing, endangered species, birds, mammals, etc. are described. The impacts which would result from oil spills are also discussed. Potential mitigating measures and then impacts are included. 33 figs., 55 tabs. (CBS)

48155 (PB–90-247552/XAB) **Environmental review of Potomac Electric Power Company's proposed Station H Element I.** Maryland Dept. of Natural Resources, Annapolis, MD (USA). Power Plant and Environmental Review Div. Apr 1990. 389p. (PPRP/PPSE/SH–2). Source: NTIS, PC A17/MF A03.

The report has been conducted to evaluate the potential impacts to environmental and cultural resources from the proposed construction and operation of Element I (the combustion turbine portion) of the Station H power plant facility at Potomac Electric Power Company's Dickerson site. This review also presents an evaluation of air quality impacts of Elements I and II (combustion turbine and combined cycle components of the facility) and an assessment of compliance with state and Federal air quality regulations (primarily the ambient air quality standards and the air quality impact requirements of PSD regulations). Results of the Environmental Review analysis are used as the basis for establishing preliminary recommended licensing conditions for operating the proposed facility. These recommendations are also included in the report.

48156 (PB–90-247727/XAB) **In-situ biorestoration of a subsoil contaminated with gasoline. Interim report.** van den Berg, R.; Verheul, J.H.A.M.; Eikelboom, D.H. Rijksinstituut voor Volksgezondheid en Milieuhygiene, Bilthoven (Netherlands). Apr 1989. 32p. (RIVM–728518005). Source: NTIS, PC A03/MF A01.

Report on the International Meeting of the NATO/CCMS Pilot Study (2nd): Demonstration of Remedial Action Technologies for Contaminated Land and Ground Water. Prepared in cooperation with Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague (Netherlands). U.S., Canada and Mexico sales only. All others refer to National Institute of Public Health and Environmental Protection, P.O. Box 1, 3720 BA Bilthoven, The Netherlands.

The objective of the research project In situ biorestoration of an oil contaminated subsoil is to study the technical and financial feasibility of this technique. In the report the results of the pilot plant scale column studies are given and discussed. Moreover, a description of the site and the design of the actual clean-up operation are given. In the undisturbed soil columns the gasoline was removed by two processes: leaching and (bio)degradation. By leaching predominantly the aromatic compounds were removed and especially in the first few weeks. Considerable (bio)degradation, besides leaching, was observed only in the cases of hydrogen peroxide used as additional oxygen source, recirculation of the effluent and a combination of these two. Both aromatic and especially aliphatic compounds were biodegraded.

48157 (PB–90-249574/XAB) **Delegations of authority under the Federal Water Pollution Control Act (FWPCA) which are applicable to the Superfund program. Directive (Final).** Environmental Protection Agency, Washington, DC (USA). Office of

Emergency and Remedial Response. 16 Apr 1984. 8p. (EPA–9260.3-00). Source: NTIS, PC A02/MF A01.

The directive identifies and delegates the applicable authorities under FWPCA for imminent and substantial threat to the public health or welfare of the United States because of an actual or threatened discharge of oil or hazardous substance into or upon the navigable waters of the United States from an onshore or offshore facility. The document delegates authority regarding the use of dispersants and responsibilities within the Spill Prevention Control and Countermeasure System (SPCC) program.

48158 (PB–90-249715/XAB) **Emergency response notification system.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. Aug 1989. 7p. (EPA–9360.0-21). Source: NTIS, PC A02.

The pamphlet provides general information for the public describing the Emergency Response Notification System, the national computer database and retrieval system that is used to store information on releases of oil and hazardous substances.

48159 (PB–90-249798/XAB) **Use of Office of Research and Development's bioremediation expertise in Superfund removal program. Directive (Final).** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 12 Mar 1990. 5p. (EPA–9380.4-01). Source: NTIS, PC A01/MF A01.

The directive establishes a formal mechanism for accessing and using the Office of Research and Development's (ORD) capabilities in the area of bioremediation of oil spills, hazardous substance spills, and Superfund removal actions.

48160 (PB–90-250127/XAB) **I/m test variability. Technical report.** Landman, L.C. Environmental Protection Agency, Ann Arbor, MI (USA). Emission Control Technology Div. Apr 1987. 85p. (EPA/AA/TSS/IM–87/2). Source: NTIS, PC A05/MF A01.

See also PB–90-235714.

The report summarizes an effort to study the emissions of vehicles that had exhibited variability on I/M tests and then to determine the effects of various preconditioning cycles on the I/M tests of those vehicles. The Federal Test Procedure hydrocarbons and carbon monoxide emissions of the vehicles continued to fail the I/M test even after loaded preconditioning tended to be higher than the emissions of the I/M-failing vehicles which passed after that loaded preconditioning. Among the closed-loop vehicles, the fuel injected cars appeared to be more likely to produce consistent I/M results than were the carbureted cars.

48161 (PB–90-250267/XAB) **Toxicology of oil-spill cleanup agents. Final report.** Tjeerdema, R.S.; Singer, M.M.; Scelfo, G.M.; Smalheer, D.L.; Swall, L.M. California Univ., Santa Cruz, CA (USA). Inst. of Marine Sciences. 1 Jul 1990. 175p. (UCSC/IMS–90/1). Source: NTIS, PC A08/MF A01.

The report describes both advanced analytical and biochemical techniques for use with surfactant-based oil spill cleanup agents. It also presents novel aquatic toxicity testing procedures, as well as the results from toxicity testing with the sensitive early life stages of diverse marine organisms. In addition, it describes the metabolic fate, including both tissue and temperature dependence, of a representative surfactant in a marine invertebrate. Finally, it delineates the in vitro effects of surfactant-based oil spill cleanup agents in both marine birds and mammals.

48162 (RRTAC–89-2-Vol.1, pp. 81-90) **First year results of revegetation trials using selected native plant species on a simulated pipeline trench, Fort Norman, N.W.T., Canada.** Maslen, L. (Spencer Environmental Management Services Ltd., Yellowknife, NT (Canada)); Kershaw, G.P. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-31 Aug 1989; MICROLOG–90-03281). In *Proceedings of the conference Reclamation, a global perspective: Volume 1.* Source: PC Alberta Queen's Printer, Publications Office, 11510 Kingsway Ave, Edmonton, AB, CAN T5G 2Y5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

Revegetation treatments using locally-collected native species and commercially-available native cultivars were seeded with and without fertilizer onto a simulated pipeline trench in a subarctic area of Canada. Local treatments included Arctagrostis latifolia, Carex membranacea, Arctostaphylos rubra, Betula glandulosa, Empetrum nigrum, Ledum groenlandicum, and Vacciniumuliginosum; commercial treatments included Alyeska polargrass, Artemesia Tilesii and Calamagrostis canadensis, and Decora seed mix (Agropyron violaceum, Festuca ovina, Poa alpima. P. glauca). Epilobium angustifolium rhizomes were also planted. B. glandulosa and L. groenlandicum seeds germinated well but remained as seedlings during the first growing season. C. membranacea and the other shrub species did not germinate. Based on above-ground production, fertilized Alyeska polargrass performed better than all other treatments and was the only treatment to respond to fertilizer. The other cultivated and locally-collected herbaceous species all established well and had similar but low above-ground production. 32 refs., 2 figs., 4 tabs.

48163 (RRTAC–89-2-Vol.1, pp. 91-99) **Revegetation in the Canadian north. A 15 year perspective: Summary of findings.** Martens, H. (Hardy BBT Ltd., Calgary, AB (Canada)); Younkin, W. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-31 Aug 1989; MICROLOG–90-03281). In *Proceedings of the conference Reclamation, a global perspective: Volume 1.* Source: PC Alberta Queen's Printer, Publications Office, 11510 Kingsway Ave, Edmonton, AB, CAN T5G 2Y5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

Reclamation studies were begun in the Canadian north in the early 1970s in response to increased activity in the oil and gas industry. Major emphasis was on revegetation, and studies included trials of species, seed mixes, fertilizers, sod stripping and replacement, mulches, and the like. Long term observations have provided useful information and the major findings of this research are summarized under the following categories: species and seed mixtures, shrub cuttings, fertilizer formulation and application rate, seed and fertilizer rate trials, sod stripping and replacement trials, and effects of seed and fertilizer on natural recovery. Lists of commercially available species of grasses and legumes useful for revegetation in the Arctic are included. The majority of species are selections from northern-adapted commercial stocks. 5 figs., 3 tabs.

48164 (RRTAC–89-2-Vol.1, pp. 415-420) **Bioremediation: innovative applications of an established technology.** League, J. (Bogart Environmental Services Inc., Mt. Juliet, TN (USA)); Bogart, J. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-31 Aug 1989; MICROLOG–90-03281). In *Proceedings of the conference Reclamation, a global perspective: Volume 1.* Source: PC Alberta Queen's Printer, Publications Office, 11510 Kingsway Ave, Edmonton, AB, CAN T5G 2Y5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

Landfarming, used in oil field and refinery reclamation projects, was the genesis of bioremediation. Traditional landfarming has undergone significant enhancements which have produced kinetic rates that are orders of magnitude greater than previously attained. Innovations in bioremediation include liquid-solids contact digestion, improved landfarming techniques, and new types of hardware use in the remediation of ground water and contaminated soils. Materials degraded by these biological methods include oil and grease, petroleum hydrocarbons, creosote, pentachlorophenol, pesticides, chlorinated aromatic hydrocarbons, refinery wastes, and chlorinated solvents. Examples of the degree of biodegradation achievable by these improved processes are presented, including up to 99% reduction in oilfield waste and 99.8% reduction in organics from petrochemical contamination. 6 tabs.

48165 (TP–208) **Maritime Pollution Claims Fund annual report, 1988-1989.** Transport Canada, Ottawa, ON (Canada). Research and Development. 1990. 9p. (MICROLOG–90-03290). Source: PC Transport Canada, Library and Information Centre, Place de Ville, Tower C, Ottawa, ON, CAN K1A 0N5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This report is the final annual report of the Fund, which was replaced in April, 1989 by the Ship-Source Oil Pollution Fund. The report describes the 1988 West Coast oil spill resulting from the collision of a U.S. tug with a U.S. tanker barge west of Gray's Harbour in the State of Washington, its effect on the West Coast of Canada, and the legal actions taken; the status of the claim in the case of the discharge of oil from a barge near Matane, Quebec in 1986; the claim for the recovery of clean-up expenses for an unidentified discharge of oil in Lake Superior near Michipicoten, Ontario in 1984; and the legal proceedings in the discharge of oil at Come By Chance in Newfoundland in 1988. Three outstanding claims, and their status, are described. Amendments to the Canada Shipping Act which will create a new legal regime for oil pollution liability and compensation in Canada include the creation of a new Fund to replace the existing Fund; Canada's involvement in the International Convention on Civil Liability for Oil Damage 1969; and Canada's membership in the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage. The status of the Fund is also given.

48166 (WAU/CGS–CE03140, pp. 272-279) **The effects of brine contamination on volume change behavior of fine grained soils.** Ho, Y.A. (Hardy BBT Ltd., Nanaimo, BC (Canada)); Pufahl, D.E.; Barbour, S.L. Canadian Geotechnical Society, Waterloo, ON (Canada). 1989. (CONF-891015–: 42. Canadian geotechnical conference, Winnipeg (Canada), 23-25 Oct 1989; CE–03140). In *Materials: From theory to practice: Proceedings.* Source: Canadian Geotechnical Society, University of Waterloo, Waterloo, ON, CAN . Prices: PRICES UPON REQUEST.

Leakage from brine containment facilities in the potash and oil industries are two major sources of brine contamination of groundwater and soil in Western Canada. An understanding of the effects of brine (electrolyte) contamination on soil properties is desirable for the proper management of waste from the potash and oil industries. The effect of brine on the volume change behavior of fine grained soils was assessed in laboratory studies. To observe the effects, remoulded clay till (Indian Head till, Saskatchewan) and lacustrine clay (Regina clay, Saskatchewan) samples were subjected to one dimensional consolidation tests. Undisturbed in-situ Regina clay samples were also used in modified one dimensional consolidation tests. The results show that the magnitude of volume reduction caused by brine permeation can be significant. The increase in apparent preconsolidation pressure caused by the brine and the observed behavior under subsequent loading does not suggest a change in soil structure. The soils formed in brine environments and exposed to fresh water underwent volume reductions and a decrease in the apparent preconsolidation pressure. These soils may also experience a change in soil structure and/or an increase in the rate of secondary consolidation as a result of submersing them in fresh water. 19 refs., 8 figs., 4 tabs.

0210 Legislation and Regulations

Refer also to citation(s) 48146, 48147

48167 (D–89-10) **Gannon Bros Energy Ltd. application for a well licence, Ewing Lake field: Decision 89-10.** Energy Resources Conservation Board, Calgary, AB (Canada). 26 Oct 1989. 5p. (CE–03132). Source: Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4. Prices: $5.00 CAN.

Gannon Bros. applied for a permit to drill a well in the Ewing Lake field to obtain oil from the Nisku Formation. An intervention was filed opposing the application and a public hearing was held to consider the need for the well, the location of the well, the access route, and the impact of the well site and access road. The intervenor wanted the access road relocated to reduce the impact of well construction and operation on his agricultural activities. The Board decided that the impacts associated with the well and the existing access road would not be so great as to deny the application. The application was therefore approved. 1 fig.

48168 (D–90-3) **Chesapeake Resources Ltd. application for a well licence, Whitemud area: Decision 90-3.** Energy Resources Conservation Board, Calgary, AB (Canada). 4 Jun 1990. 7p. (CE–03128). Source: Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4. Prices: $5.00 CAN.

An application was made for a license to drill an oil or gas well in a populated area near Edmonton, Alberta. A public hearing was held to examine issues related to the well application. Issues considered at the hearing were the need for the well, the effects of drilling the well on the neighboring residences, and the impact of drilling on a nearby alpaca ranch. The need for the well was confirmed, as there is no other existing well in the section capable of draining any reserves that may be in the targeted formation. The effects of drilling on the residences, such as noise and spills, were considered to be capable of being reduced to acceptable levels. Discussion of the impact of drilling on the alpacas focused on noise pollution. It was concluded that the relatively short duration of drilling, and the commitments made by the applicant to minimize noise levels, mean that these impacts would not be significant. The application was accordingly approved, with certain conditions imposed on the applicant to control noise and other impacts. 1 fig.

0220 Transport, Handling, and Storage

48169 (CPA/PD–90-03302) **Oil pipeline performance review, 1986.** Canadian Petroleum Association, Calgary, AB (Canada). Pipeline Div. 1986. 31p. (MICROLOG–90-03302). Source: Canadian Petroleum Association, 3800 - 150 6th. Ave. S.W., Calgary, AB, CAN T2P 3Y7. Prices: PRICES UPON REQUEST.

The performance of Canadian oil pipelines for 1986 is reviewed and compared with that of 1985. Total 1986 failures per 1000 km of pipeline were down from 1.4 to 1.2. Costs of repair and cleanup were 31% of the 1985 costs and 58% of the previous 9-year average. In-service length of the systems reporting increased to 32,617 km, deliveries increased 4%, but traffic volume decreased 2%. Thirty-nine failures were reported, of which 13 were due to operational error, 10 to corrosion, and 7 due to equipment failures. The average spill size in 1986 was 21% of the 1985 average, and spilled volume decreased by 81% to 2,055 cubic meters. Failures resulted in 4 injuries, 2 fires, and one explosion with fire. No line pipe failures due to defective pipe were reported. A 10 year statistical summary of oil pipeline performance data also included. 3 figs., 5 tabs.

48170 (MIC–90-03090/XAB) **Potential issues associated with shipping oil and gas through the Labrador Sea and Strait of Belle Isle.** Environmental Advisory Committee on Newfoundland and Labrador Marine Transportation (Canada). ©1989. 97p. Source: NTIS, PC EE07/MF E01.

The Committee was established in October 1984, reporting to the Canadian Coast Guard-Newfoundland Region, to provide a forum for consultation among the government, native groups, industry and others on environmental and resource use activities relating to the management of shipping routes and ship movements within the waters surrounding Newfoundland and Labrador; to review marine shipping proposals and to determine potential implications for the environment and for natural resource users; to recommend preventative measures and guidelines for shipping routes and ship movement; and to identify environmental information gaps. This information report was prepared for distribution to the residents of the Labrador Coast and Strait of Belle Isle and covers management of shipping, tanker movement, tanker specifications and safety concerns, the causes and effects of tanker damage, reporting oil spills, contingency planning, environmental protection legislation, the effects of existing tanker traffic, marine services, compensation, and business and related opportunities.

48171 (MIC–90-03115/XAB) **Response to recommendation No. 80, Beaufort Sea environmental assessment and review panel: Final report, 1984-89.** Saskatchewan District, Regina

(Canada). Water Resources Branch. ©1989. 74p. Source: NTIS, PC EE07/MF E01.

In 1980, the Dept. of Indian Affairs and Northern Development initiated a formal public review of a proposed oil development project in Canada's Arctic under the federal Environmental Assessment and Review Process. The project included production of oil from the Beaufort Sea and transport of the oil to southern markets by pipeline, tanker or both. The Beaufort Sea Environmental Assessment Panel was appointed in 1981 to review the activities involved, to identify potential impacts of the project and to recommend mitigative measures. The review included activities north of 60N latitude. In October 1984 the Environmental Advisory Committee on Newfoundland and Labrador Marine Transportation was established to review marine shipping in its area and to recommend preventative measures and guidelines. This report presents its findings on the socio-economic and environmental aspects of tanker traffic, reviews marine shipping activities and their potential impacts, and gives control measures.

48172 (SRC–R-1110-2-C-89) **Effects of produced sand on short distance pipeline transportation of heavy oil in water emulsions: SRC [Saskatchewan Research Council] pipeloop test results: Final report.** Gillies, R. (Saskatchewan Research Council, Saskatoon, SK (Canada)); Small, M.; Shook, C.A. Saskatchewan Research Council, Saskatoon, SK (Canada). Dec 1989. 50p. Contract EMR 23440-8-9031/01-SQ. (MICROLOG–90-03968). Source: PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The flow behaviour of high concentration heavy crude oil in water emulsions was studied by using a 53 mm diameter recirculating flow pipeline loop. The test results confirmed the potential of oil/water emulsion technology for reducing heavy oil pipeline operating costs. Under the laminar flow conditions of the tests, the pumping energy required to transport an emulsion containing 70% crude oil was only about 1% of that required to transport the heavy crude oil alone. The effect of temperature and sand content on the flow resistance of high concentration oil in water emulsions were studied. The temperature effect could be explained through changes in the viscosity of the brine used to prepare the emulsions. Sand in the oil either increased or decreased the flow resistance depending upon the amount of water present initially in the oil. The sand flowed in a distinct layer at the bottom of the pipe and the velocity necessary to transport the sand was strongly dependent on emulsion effective viscosity. The tests showed that emulsion durability increased with surfactant dosage and water content, and decreased rapidly with increasing sand content. Emulsion durability was also affected by the type of pump used to recirculate the mixtures. Velocity distribution measurements and finite element simulation showed that a region of low viscosity forms at the pipe wall as a result of oil droplet migration into the flow. 5 refs., 15 figs., 8 tabs.

0230 Properties and Composition

Refer also to citation(s) 48090, 49065, 49066, 49067, 49069

48173 (MIC–90-03383/XAB) **Study of asphaltene flocculation in heavy oil and asphalt solutions.** Fuhr, B.J. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). ©1989. 46p. Contract CANMET-79131-01-SQ. Source: NTIS, PC EE07/MF E01.

Two different experimental set-ups are described for determining the onset of asphaltene precipitation in heavy oil solutions. The first system, applicable to experiments under ambient conditions, employs a visible spectrophotometer with flow-through cell. The second, which must be used for experiments at pressures above atmospheric, employs a fiber optics probe which can operate in the visible and near infrared region. A number of heavy oil and asphalt systems were studied using these experimental techniques. This report compared the flocculation data of various heavy oils and residues from different sources, and correlated these results with known background of the samples, as well as determining the relative effects of dissolved CO_2 and propane on the flocculation of asphaltenes in a heavy oil.

48174 (NDA/NF–90-03383) **A study of asphaltene flocculation in heavy oil and asphalt solutions: Final report.** Fuhr, B.J. (Alberta Research Council, Edmonton, AB (Canada)); Coates, L.; Klein, L.; Reichert, C.; Steppler, J. Nolan, Davis and Associates Ltd., St. John's, NF (Canada); Alberta Research Council, Edmonton, AB (Canada). Oil Sands Hydrocarbon Recovery. Sep 1989. 47p. Contract EMR 23440-7-9131/01-SQ. (MICROLOG–90-03383). Source: PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Two different experimental set-ups are described for determining the onset of asphaltene precipitation in heavy oil solutions. The first system, applicable to experiments under ambient conditions, employs a visible spectrophotometer with flow-through cell. The second, which must be used for experiments at pressures above atmospheric, employs a fiber optics probe which can operate in the visible and near infrared region. A number of heavy oil and asphalt systems were studied using these experimental techniques. First of all, the degree of chemical alteration of fireflood oils compared to primary production oils was found to correlate with the asphaltene flocculation results. Secondly, it was found that both CO_2 and propane dissolved in heavy oil solutions increase the tendency for asphaltene precipitation. This effect is reduced with an increase in temperature, presumably because of a reduction in the solublity of these gases. Thirdly, natural gas liquids of relatively high aromatics content have a low tendency to precipitate asphaltenes, and would therefore make good heavy oil diluents. Finally, there appears to be a correlation between asphalt stability, as measured by a standard settling test, and the asphaltene precipitation tendency as determined by the flocculation test. 19 refs., 13 figs., 10 tabs.

48175 Vanadyl model compounds in size exclusion-inductively coupled plasma-atomic emission (SEC-ICP-AES) studies of metal complexes in heavy crude oils and residua. Biggs, W.R. (Chevron Research Company, Richmond, CA (USA)); Reynolds, J.G. pp. 34, Paper INOR 112 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

The authors have studied the size behavior of vanadium and nickel compounds in heavy crude oil and residua processing utilizing SEC-ICP-AES. The relative size relationship has yielded much information about several processes, particularly about catalyst pore-metal compound interactions. However, calibrations by standard methods can give misleading results, particularly in the high molecular weight range. To overcome this, we have studied several vanadyl model compounds under typical elution conditions used for the heavy crude oil and residua studies. The results of these studies, and how they relate to the characterization of the porphyrin and metallo-nonporphyrin type metals will be discussed.

0250 Combustion

48176 (CFD–87/8) **The combustion of liquid fuels.** Spalding, D.B. (Imperial Coll. of Science and Technology, London (UK). Computational Fluid Dynamics Unit). Imperial Coll. of Science and Technology, London (UK); Cambridge Univ. (UK). Sep 1987. 189p. Source: Available from British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

First published in Autumn 1951.

The vaporisation of sprays of liquid was studied as this was clearly an important component process in the burning of liquid fuels, the 'double-film' theory of Weber and Nillson, and Hatta, for simultaneous diffusion and chemical reaction was applied to liquid fuel combustion where heat conduction also occurs, and combustion rates were predicted. Experiments on combustion by natural convection were carried out and forced convection was investigated experimentally. A theory of combustion in a boundary layer was

developed. This discarded the stagnant-film concept, but still supposed chemical reaction to take place at a thin surface. The new theory was supported by experimental combustion rates. (author).

03 NATURAL GAS

48177 (PB–90-247412/XAB) **Gas Research Institute 1991-1995 research and development plan and 1991 research and development program.** Gas Research Inst., Chicago, IL (USA). Jun 1990. 401p. (GRI–90/0166). Source: NTIS, PC A18/MF A03.

The 1991-1995 GRI R&D Plan and 1990 R&D Program describes the planning framework used to develop the GRI R&D program and provides an overview of the 1991 R&D budget and program direction. The R&D rationale, objectives, goals, accomplishments, strategies, and milestones are described for GRI's objectives in Supply Options, End Use, Gas Operations, and Crosscutting Research. Appendixes include the rosters of GRI's member companies, major advisory bodies, and professional staff; the project level budget and research objective summaries for R&D proposed for 1991; and a glossary of terms.

48178 (PB–90-252545/XAB) **Physical Sciences Program Area 1990 contract status report.** Dolenc, D.A. Gas Research Inst., Chicago, IL (USA). Jul 1990. 256p. (GRI–90/0181). Source: NTIS, PC A12/MF A02.

See also PB–89-217947.

The report summarizes the 1990 status of research contracts funded and managed by GRI's Physical Science Department. Eleven research areas are grouped according to the elements of GRI's mission: Gas Supply Options, End Use, Gas Operations, and Crosscutting Research. The description of each contract includes the reasons for funding the research, its objectives, and a statement of accomplishments.

0302 Reserves, Geology, and Exploration

Refer also to citation(s) 48124, 48125, 48130, 48131

48179 (PB–90-247404/XAB) **Organic chemistry of mantle-derived xenoliths: Assessing the possibilities for deep sources of natural gas. Biennial report, November 1987-November 1989.** Tingle, T.N.; Hochella, M.; Becker, C.H.; Malhotra, R.; Graham, S. Stanford Univ., CA (USA). Dept. of Geology. Nov 1989. 135p. Contract GRI-5087-260-1626. Source: NTIS, PC A07/MF A01.

The type and distribution of organic compounds present in samples of the Earth's mantle have been characterized by surface analysis by laser ionization, field ionization mass spectrometry, X-ray photoelectron spectroscopy, and carbon X-ray microscopy. The most commonly observed organic species are olefins (propene, butene, hexene) and aromatic compounds (benzene and toluene). Less commonly observed compounds include methanol, butoxy, butyl amine, alkyl fragments (propyl, butyl, and hexyl), dihydroxyphenanthrene, and possibly some oxygen- and nitrogen-containing organic compounds. The organic compounds are associated with condensed carbonaceous material on crack surfaces and fluid inclusion walls in mantle xenoliths and basalt. The distribution of organic matter is heterogeneous among samples from the same volcano and even in single crystals. The information is being used to test and refine theories concerning the nature and distribution of abiogenic hydrocarbons in the Earth's crust and upper mantle.

0303 Drilling, Production, and Processing

Refer also to citation(s) 48133

0305 Health and Safety

Refer also to citation(s) 48191

0306 Economic, Industrial, and Business Aspects

Refer also to citation(s) 48144, 48771

48180 (DOE/EIA–0130(90/06)) **Natural gas monthly, June 1990.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 31 Aug 1990. 169p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE90017703. Source: NTIS, PC A08/MF A01 - GPO - OSTI; GPO Dep.

This report highlights activities, events, and analyses of interest to public and private sector organizations associated with the natural gas industry. Volume and price data are presented each month for natural gas production, distribution, consumption, and interstate pipeline activities. Producer-related activities and underground storage data are also reported. From time to time, the NGM features articles designed to assist readers in using and interpreting natural gas information. 7 figs., 33 tabs.

48181 (MPUB–90-00338) **The [Manitoba] Public Utilities Board annual report, 1988.** Manitoba Public Utilities Board, Winnipeg, MB (Canada). 1988. 54p. (MICROLOG–90-00338). Source: PC Manitoba Public Utilities Board, 280 Smith Street, 2nd Floor, Winnipeg, MB, CAN R3C 1K2; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

The Manitoba Public Utilities Board is responsible for regulation of provincial public utilities including gas distribution services and pipelines, hydroelectric utilities, telephone systems, and water services. A summary is presented of the Board's activities in 1988 including decisions on applications and appeals. Highlights of the year include an agreement on natural gas markets and prices with the federal government and other gas-producing provinces, and the consequent hearings on natural gas contracts of 2 Manitoba companies, Greater Winnipeg Gas and ICG; approval of buy-sell agreements entered into by those same companies; a rate base determination for Stittco Utilities, a propane distributor; and a review of Manitoba Hydro rates. 5 figs., 1 tab.

0308 Environmental Aspects

Refer also to citation(s) 48149, 48154, 48155, 48163, 48170, 48705, 48734, 49585

48182 (D–89-11) **Application by Canadian Western Natural Gas Company Limited for a permit to construct a pipeline to transport natural gas in the Magrath area: Decision 89-11.** Energy Resources Conservation Board, Calgary, AB (Canada). 27 Dec 1989. 9p. (CE–03130). Source: Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4. Prices: $5.00 CAN.

Canadian Western Natural Gas Co. Ltd. submitted an application for a permit to construct approximately 12 km of pipeline loop, 114.3 mm in outside diameter, to transport natural gas in the Magrath area of Alberta. The Board identified the issues as the need for the pipeline, its routing and potential surface impacts, and other potential environmental concerns. This document gives the views of the applicant, the intervenors, and the Board on each of these issues, as well as concerns about increased costs for other users of the system, communication between this gas pool and a nearby gas pool, and protection of the public interest. The Board granted the application, subject to receipt of the approval of the Minister of the Environment respecting environmental matters. 1 fig.

48183 (RRTAC–89-2-Vol.2, pp. 627-634) **Characterization of leachate produced from sulphur-contaminated soils.** Leggett, S.A. (Jim Lore and Associates Ltd., Calgary, AB (Canada)); Parkinson, D. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-31 Aug 1989; MICROLOG–90-03431). In *Proceedings of the conference Reclamation, a global perspective: Volume 2.* Source: PC Alberta Queen's Printer, Publications Office, 11510 Kingsway Ave, Edmonton, AB, CAN T5G 2Y5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

Reclaiming soils that are heavily contaminated with elemental sulphur is a problem specific to a small part of the oil and gas

industry. Characterization of leachate produced from sulphur-contaminated soils will aid in the evaluation of potentially related environmental and health impacts. Leachate was collected at initiation and completion of a greenhouse growth trial from pots containing four sulphur levels (<0.1%, 4%, 9%, and 14% total sulphur) and four reclamation treatments (no treatment, limestone, limestone and manure, and manure). Leachate samples were analyzed for pH, electrical conductivity, nitrate-nitrogen, ammonium-nitrogen, sulphate-sulphur and phosphate-phosphorous. Selected subsamples were acidified and analyzed for soluble aluminum, iron and manganese. Leachate produced from unlimed, sulphur-contaminated soils were strongly acidic while the pH of leachate produced from limed, sulphur-contaminated soils was neutral. Electrical conductivity values were highest in leachate produced from unlimed, sulphur-contaminated soils. Leachate produced from unlimed sulphur-contaminated soils also contained elevated levels of nitrogen, phosphorous, and sulphur as well as elevated levels of soluble aluminum, iron and manganese. Leachate produced from limed, sulphur-contaminated soils contained elevated levels of sulphate-sulphur. Results obtained from this experiment indicate that a delay in neutralizing a soil that is heavily contaminated with elemental sulphur could cause a movement of soluble metals down the soil profile and may also cause a drain of potentially available nutrients that are required for plant growth. 6 refs., 7 tabs.

0310 Legislation and Regulations

Refer also to citation(s) 48168, 48738

48184 (D–89-9) **Amoco Canada Resources Ltd., Chevron Canada Resources, Kaybob South Beaverhill Lake A pool: Decision 89-9.** Energy Resources Conservation Board, Calgary, AB (Canada). 4 Dec 1989. 13p. (CE–03131). Source: PC Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $5.00 CAN; MF $10 CAN.

Amoco Canada Resources Ltd. and Chevron Canada Resources applied separately to wind down dry gas cycling and proceed with maximum practical gas withdrawals so as to achieve rapid 'blowdown' of the remaining gas reserves in Kaybob South Beaverhill Lake gas units no. 2 and 3. After a pre-hearing meeting, the Board decided to focus on the technical aspects of achieving optimum energy resource conservation. The views of Amoco, Chevron and the Board are summarized for the following issues: the importance of initiating blowdown, the concomitant means of optimizing recovery, and monitoring of the proposed scheme. The Board agreed that early blowdown would optimize energy conservation from the pool but reiterated that firm commitments to operate the blowdown schemes were needed to ensure maximum recovery. An earlier memorandum of decision and the text of a previous interim decision are included. 3 tabs., 1 fig.

48185 (D–90-7) **Daishowa Canada Ltd., Peace River pulp mill industrial development permit to use gas as a supplementary fuel: Decision 90-7.** Energy Resources Conservation Board, Calgary, AB (Canada). 18 Jul 1990. 17p. (CE–03129). Source: Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4. Prices: $5.00 CAN.

Daishowa Canada applied for a permit to authorize an annual use of up to 80.2 million cubic meters of natural gas as a supplementary fuel in the production of 340 air-dried kilotonnes per year of bleached kraft pulp. A public hearing was held to consider issues related to the application. The scope of the hearing was restricted to the use of gas at the mill. Issues considered at the hearing included the availability of the gas, alternatives to the use of gas, environmental impacts from using gas, and net economic benefits. It was decided that there are ample gas supplies, that use of gas is environmentally optimum, and that maximum economic benefits will accrue from the use of gas. The application was therefore approved.

48186 (IL–90-9) **Government of Alberta ethane policy implementation procedures: Information letter 90-9.** Energy Resources Conservation Board, Calgary, AB (Canada). 16 Jul 1990. 31p. (CE–03127). Source: Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4. Prices: $5.00 CAN.

Over the past 10 years an ethane-based petrochemical industry has been established in Alberta. These plants receive their ethane feedstock mainly from straddle plant facilities. Over this same period, there has also been an increasing demand for field extraction of ethane to provide solvent for enhanced oil recovery and, potentially, to provide feedstock for petrochemical facilities. Construction of ethane extraction facilities upstream of straddle plants would remove ethane which would otherwise be available to those plants. As a result of the potential conflicts between field producers, the petrochemical industry, and other interested parties, hearings have been conducted in Alberta on measures to improve the situation. As a result, an ethane policy has been established, and procedures used to implement this policy are described. Details are provided on the following: facilities that are subject to the ethane policy; the principles and methods for determination of the threshold volume which would ensure a security of ethane supply to the petrochemical industry; adjustments which may be necessary to the threshold volume; the monitoring of ethane available at the straddle plants and maintenance of the threshold volume; the duration of the ethane policy; means for establishing the price to be paid for reinjected ethane; procedures for handling applications for new field plants for recovering ethane; and the conditions pertaining to ethane that will be included in future field plant approvals. 1 fig., 4 tabs.

48187 (NEB-SS–22-1/1990-5E) **Reasons for decision [in the matter of a] review of the applications for gas export licences from Direct Energy Marketing Limited, Indeck Gas Supply Corporation, Shell Canada Limited and Western Gas Marketing Limited as agent for TransCanada PipeLines Limited.** National Energy Board, Ottawa, ON (Canada). Jun 1990. 23p. (CE–03123). Source: National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, ON, CAN K1A 0E5. Prices: N/C.

As part of an earlier proceeding, the National Energy Board heard the gas export licence applications of Direct Energy Marketing, Indeck Gas Supply, Shell Canada and Western Gas Marketing as agent for TransCanada PipeLines, and denied them. Subsequent to the release of this decision, the Board reviewed and reappraised certain aspects of the Market-Based Procedure that it uses to consider gas export licence applications, and the following modifications were made: the Board decided it would no longer use benefit-cost analysis, but would continue to examine contracts underlying gas export applications to ensure their commercial substance. In the light of these modifications, the decision concerning the above companies was reconsidered. This document presents the Board's view on the changed circumstances, gas supply, environmental screening and disposition for each of the companies in turn. Gas export licences were issued to all of the companies, subject to certain individual conditions. 3 figs., 4 tabs.

48188 (NEB-SS–22-1/1990-5F) **Reasons for decision [in the matter of a] review of the applications for gas export licences from Direct Energy Marketing Limited, Indeck Gas Supply Corporation, Shell Canada Limited and Western Gas Marketing Limited as agent for TransCanada PipeLines Limited.** National Energy Board, Ottawa, ON (Canada). Jun 1990. 24p. (CE–03124). Source: National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, ON, CAN K1A 0E5. Prices: N/C.

As part of an earlier proceeding, the National Energy Board heard the gas export licence applications of Direct Energy Marketing, Indeck Gas Supply, Shell Canada and Western Gas Marketing as agent for TransCanada PipeLines, and denied them. Subsequent to the release of this decision, the Board reviewed and reappraised certain aspects of the Market-Based Procedure that it uses to consider gas export licence applications, and the following modifications were made: the Board decided it would no longer use benefit-cost analysis, but would continue to examine contracts underlying gas export applications to ensure their commercial substance. In the light of these modifications, the decision concerning the above companies was reconsidered. This document presents the Board's view on the changed circumstances, gas supply, environmental screening and disposition for each of the companies in

turn. Gas export licences were issued to all of the companies, subject to certain individual conditions. 3 figs., 4 tabs.

0320 Transport, Handling, and Storage

Refer also to citation(s) 48170, 48738, 48792

48189 (MIC–90-03376/XAB) **Pressure history of a gas pipeline.** Vosikovsky, O. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). ©1990. 11p. Source: NTIS, PC EE07/MF E01.

Extensive stress corrosion cracking (SCC) has been found in Canadian gas pipelines and beginning in 1985, has resulted in several operational and hydrotest failures in lines operated by TransCanada Pipelines (TCPL). Examination of failures and extensive field research revealed that SCC in Canadian pipelines differs from the known classical SCC in that the electrolytes found above SC cracks are dilute and have lower pH (near neutral). The crack tip strain rate generated (among other factors) by stresses from pressure fluctuations in a pipeline is one of the most important parameters controlling the crack growth rate. Since representative pressure histories of gas pipelines are not available, cycle counting was performed on the TCPL pipeline which experienced several service failures. The method of cycle counting and the results - a 1-year pressure sequence to be used in SC crack growth rate tests - are described.

48190 (PB–90-252552/XAB) **State-of-the-art interior-piping-systems application: On-site H_2S/O_2 removal technology. Final report, June 1988-March 1989.** Rubin, L. Foster-Miller, Inc., Waltham, MA (USA). Dec 1989. 57p. Contract GRI-5087-271-1611. Source: NTIS, PC A04/MF A01.

Copper tubing is the most cost-effective piping technology presently available for interior gas distribution systems. Its use, however, has been greatly restricted. Corrosion has been cited as the most prevalent reason utilities have been reluctant to use copper tubing. Hydrogen sulfide (H2S) has been identified as one of the main contaminants in natural gas which promotes copper corrosion. The goal of the program was to develop an on-line filter for removing H2S from delivered natural gas without removing the mercaptans (oderant). The filter was to be sized for single family dwellings and provide a 1- to 2-year life. Zeolite based molecular sieves were the first materials evaluated for H2S adsorption. Testing using gravimetric techniques (batch measurement approach for determining equilibrium adsorption capacity) revealed that commercial and modified zeolites adsorbed virtually zero H2S when processing methane, which contains typical H2S concentrations (1 to 4 ppm). The second type of adsorbent evaluated, activated alumina, was capable of adsorbing H2S at the low H2S concentration typically found in delivered natural gas. The specific activated alumina tested, Selexsorb COS, had a H2S adsorption capacity of 0.8 gm/100 gm. The mercaptan rejection capability was attained by presaturating the adsorbent with mercaptan prior to placing the adsorbent into service.

48191 (TU/CEAC–90-03943) **Propane storage. Report on hazard and risk assessment of propane storage on garage forecourts.** Napier, D.H.; Leers, H.-D. Toronto Univ., ON (Canada). Dept. of Chemical Engineering and Applied Chemistry. May 1989. 157p. (MICROLOG–90-03943). Source: PC Toronto Planning and Development Dept, Library, City Hall, 19th Floor, East Tower, Toronto, ON, CAN M5H 2N2; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

A study is presented of the types and magnitudes of hazards involved with a propane tank and ancillary equipment used at a propane filling station. Methods are provided to assist in determining the risk from the consequences of these hazards. The loss of containment of propane is the initiating event in any hazard, and in general, such hazards involve asphyxiation, fire, and/or explosion. The frequency of failure of the tank and ancillary equipment, along with probability of damage by an external force, are examined in order to determine the frequency of a hazard. The magnitude of the hazard is a function of the amount and mode of release of the propane. Low-frequency high-consequence events include failure of containment of the storage tank, and higher-frequency lower-consequence events include failures of and accidental damage to pumps, hoses, and valves. The results of these events are discussed in detail, including unconfined vapor cloud explosions, boiling liquid expanding vapor explosions, fireballs, and jet flames. The consequences of these events include blast waves, missiles, flame impingement, and thermal radiation. The results from loss of containment are evaluated in terms of the properties of propane, characteristics of release and ignition, and proximity of buildings and personnel to the point of release. The risks to an individual for propane are compared to those for gasoline, and it is seen that higher standards of operation, planning, and regulation are required for propane. 27 refs., 12 figs., 50 tabs.

0340 Combustion

Refer also to citation(s) 48121, 48845

04 OIL SHALES AND TAR SANDS

48192 (CU/FCE–CE03118) **Challenges and innovations 1990. Seventh annual heavy oil and oil sands technical symposium.** Calgary Univ., AB (Canada). Faculty of Continuing Education. 1990. vp. (CONF-9003204–: 7. annual heavy oil and oil sands technical symposium, Calgary (Canada), 14 Mar 1990; CE–03118). Source: Faculty of Continuing Education, University of Calgary, 2500 University Drive, N.W., Calgary, AB, CAN T2N 1N4. Prices: PRICES UPON REQUEST.

A symposium was held to exchange information on recent Canadian developments relating to heavy oil and oil sands technology and processes. Papers were presented on heavy oil and bitumen upgrading, in situ monitoring of enhanced recovery processes, mathematical models of steam injection phenomena, economic aspects, steam generation by coal combustion, heavy oil plant design, and sand disposal. Separate abstracts have been prepared for 9 papers from this symposium.

0402 Reserves, Geology, and Exploration

Refer also to citation(s) 48131

0404 Oil Production, Recovery, and Refining

48193 (CU/FCE–CE03118, pp. 1-10, Paper 10) **Important design considerations for heavy oil plants.** Chang, F. (Shell Canada Ltd., Calgary, AB (Canada)). Calgary Univ., AB (Canada). Faculty of Continuing Education. 1990. (CONF-9003204–: 7. annual heavy oil and oil sands technical symposium, Calgary (Canada), 14 Mar 1990; CE–03118). In *Challenges and innovations 1990. Seventh annual heavy oil and oil sands technical symposium.* Source: Faculty of Continuing Education, University of Calgary, 2500 University Drive, N.W., Calgary, AB, CAN T2N 1N4. Prices: PRICES UPON REQUEST.

Heavy oil processing from in situ operations is difficult due to the highly viscous crude, stable oil/water emulsion, co-produced solids, and high carbon dioxide gas content in the produced fluids. The complex nature of these fluids, changing production rates, and changes in their properties over time make facility design a serious challenge. Experience gained in plant design at two projects producing heavy oil from the Peace River deposit is described to illustrate the important design considerations used for a cost-effective and reliable surface facility design. Descriptions are provided of the well testing equipment, the gathering facility and the problems encountered with slugging flow, the degasser, the free water knockout vessels and oil treaters, the desanding system, heat exchangers used in heat recovery, and the produced water treating and disposal system. Other design considerations discussed include process simulation, diluent quality control, and production accounting. 2 figs.

48194 (CU/FCE–CE03118, pp. 1-17, Paper 9) **A coal fired steam generator demonstration for heavy oil recovery operations.** Aiello, J.P. (Esso Resources Canada Ltd., Calgary, AB

(Canada)); Bateson, G.D. Calgary Univ., AB (Canada). Faculty of Continuing Education. 1990. (CONF-9003204--: 7. annual heavy oil and oil sands technical symposium, Calgary (Canada), 14 Mar 1990; CE-03118). In *Challenges and innovations 1990. Seventh annual heavy oil and oil sands technical symposium.* Source: Faculty of Continuing Education, University of Calgary, 2500 University Drive, N.W., Calgary, AB, CAN T2N 1N4. Prices: PRICES UPON REQUEST.

A demonstration project at a heavy oil production project in the Cold Lake Deposit uses coal-fired technology for steam generation. The objective of the project is to develop a coal-fired technology that can utilize Alberta's abundant reserves of low-sulfur, low-cost subbituminous coal to replace natural gas and provide a reliable and efficient steam supply for steam injection processes, while exceeding strict environmental limitations. The technology being demonstrated is a low NO_x-SO_x (LNS) burner technology patented by TransAlta Resources. The burner controls sulfur dioxide by the use of calcium, either inherent in the coal or added as limestone, to capture the sulfur and form a solid compound. The fuel-bounded nitrogen is first converted to molecular nitrogen within the burner, and new thermal NO_x is prevented from forming as combustion continues in the boiler. The above two processes occurring in the burner are synergistic, and initial testing showed that the percentage of sulfur dioxide captured can be as high as 95% with NO_x levels close to zero. Pilot-scale tests demonstrated 70% sulfur dioxide reduction, 80-90% NO_x reduction, 80% slag/fly ash removal, and 96-99% carbon burnout could be achieved using the LNS burner. A demonstration facility scaled up to 50 MBtu/h is being constructed at Cold Lake. The facility has 4 major systems: coal receiving and storage, coal preparation, coal combustion, and solid waste handling. Operation is scheduled to being in April 1990. 6 figs., 1 tab.

48195 (CU/FCE-CE03118, pp. 1-26, Paper 7) **The CANMET [Canada Centre for Mineral and Energy Technology] emulsion upgrading process.** Bruijn, T.J.W. de (Energy, Mines and Resources Canada, Ottawa, ON (Canada)); Woods, H.J.; Maidment, P.M. Calgary Univ., AB (Canada). Faculty of Continuing Education. 1990. (CONF-9003204--: 7. annual heavy oil and oil sands technical symposium, Calgary (Canada), 14 Mar 1990; CE-03118). In *Challenges and innovations 1990. Seventh annual heavy oil and oil sands technical symposium.* Source: Faculty of Continuing Education, University of Calgary, 2500 University Drive, N.W., Calgary, AB, CAN T2N 1N4. Prices: PRICES UPON REQUEST.

A low cost heavy oil emulsion upgrading process is being developed that breaks the heavy/oil water emulsion and upgrades the heavy oil. The process reduces or eliminates both the need for diluent for the heavy oil and water separation techniques to break the emulsions. This concept of combining emulsion breaking and upgrading has been investigated by heating the heavy oil emulsion and a small amount of catalyst under pressure to reaction conditions. At this point the water present in the emulsion reacts with added carbon monoxide (CO) to generate hydrogen in situ. Part of the produced hydrogen hydrogenates the oil and prevents the formation of coke, but overall the process has a net production of hydrogen. The exploratory research program was carried out in batch and semi-continuous autoclaves using three steamflood emulsions and one fireflood. Results showed that the water-gas shift reaction proceeds at a relatively low temperature and produces more hydrogen than is being used in the process; a net hydrogen gain results which could be used, for example to hydrotreat secondary streams in an integrated plant. The hydrogen production (water-gas shift reaction) is influenced by operating conditions such as CO and water concentrations and residence times. However, the water-gas shift reaction appears to reach equilibrium relatively fast. Conversely, the pitch conversion is only influenced by the residence time. By proper selection of the operating conditions, viscosities and densities were obtained that were lower than the pipeline specifications. Any traces of waste remaining separated easily. Simultaneously, significant levels of desulphurization, denitrogenation, demetallization, Conradson carbon residue removal and aspaltene reduction were obtained. 1 ref., 15 figs., 4 tabs.

48196 (CU/FCE-CE03118, pp. 1-26, Paper 5) **Steam circulation in horizontal wellbores.** Arthur, J.E. (Essien Consulting Engineers Ltd., Calgary, AB (Canada)); Best, D.A.; Lesage, R.P. Calgary Univ., AB (Canada). Faculty of Continuing Education. 1990. (CONF-9003204--: 7. annual heavy oil and oil sands technical symposium, Calgary (Canada), 14 Mar 1990; CE-03118). In *Challenges and innovations 1990. Seventh annual heavy oil and oil sands technical symposium.* Source: Faculty of Continuing Education, University of Calgary, 2500 University Drive, N.W., Calgary, AB, CAN T2N 1N4. Prices: PRICES UPON REQUEST.

A model to evaluate heat losses, steam quality and pressure profiles during steam circulation in a wellbore has been developed. The model's unique ability to simulate countercurrent flow streams accounts for the interactions of heat transfer, fluid flow, phase changes, slippage between steam and water, and flow regime changes. It is based on the conservation equations of mass, momentum and energy. The energy conservation equations can account for heat transfer in a stagnant annular gas blanket as well as the transient heat loss to the overburden and the reservoir. The mixture densities and frictional pressure drops were evaluated from two phase flow correlations. The heat transfer from the flowing streams was calculated from overall heat transfer coefficients involving thermal resistances and film condensation/vaporization coefficients. The conservation equations were solved iteratively by the Newton-Raphson method. The development of this model arose from a need to determine the wellbore heat loss distribution during the warm-up phase at Mobil Oil Canada's horizontal well project in the Cold Lake Deposit. Results from the model are verified with actual field data. 12 refs., 20 figs., 1 tab.

48197 (CU/FCE-CE03118, pp. 1-28, Paper 4) **Experiences with in situ monitoring instrumentation at AOSTRA's [Alberta Oil Sands Technology and Research Authority] underground test facility.** Suggett, J. (Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada)); Collins, P.M.; Stokes, A.W. Calgary Univ., AB (Canada). Faculty of Continuing Education. 1990. (CONF-9003204--: 7. annual heavy oil and oil sands technical symposium, Calgary (Canada), 14 Mar 1990; CE-03118). In *Challenges and innovations 1990. Seventh annual heavy oil and oil sands technical symposium.* Source: Faculty of Continuing Education, University of Calgary, 2500 University Drive, N.W., Calgary, AB, CAN T2N 1N4. Prices: PRICES UPON REQUEST.

The Alberta Oil Sands Technology and Research Authority has been conducting thermal in situ bitumen recovery tests at the Underground Test Facility, northwest of Fort McMurray Alberta, since November, 1987. The processes being studied are the Steam Assisted Gravity Drainage process and Chevron's patented Heated Annulus Steam Drive process. Both pilots use horizontal wells drilled from tunnels in the limestone underlying the Athabasca Deposit, in their recovery process. As part of the two projects, 35 vertical observation wells were installed to monitor the growth of the steam zones. Instrumentation includes thermocouples, piezometers, extensionmeters, and inclinometers. Thermocouples were also installed in three of the horizontal wells. More recently, passive seismic monitoring has been included and cross hole seismic is planned for the rest phase of the project. This paper discusses the success of the instrumentation to date, including attrition, proposed improvements to the designs and installation techniques, and the anticipated in situ monitoring program. 8 refs., 13 figs.

48198 (CU/FCE-CE03118, pp. 1-20, Paper 2) **Recent developments in donor solvent upgrading (DRB).** Parker, R.J. (Alberta Research Council, Devon, AB (Canada)); Simpson, P.L.; Walker, A. Calgary Univ., AB (Canada). Faculty of Continuing Education. 1990. (CONF-9003204--: 7. annual heavy oil and oil sands technical symposium, Calgary (Canada), 14 Mar 1990; CE-03118). In *Challenges and innovations 1990. Seventh annual heavy oil and oil sands technical symposium.* Source: Faculty of Continuing Education, University of Calgary, 2500 University Drive, N.W., Calgary, AB, CAN T2N 1N4. Prices: PRICES UPON REQUEST.

Experiments have been conducted using the Gulf Canada donor refined bitumen process in order to confirm previous test results and to examine the chemistry involved in the process, in particular the impacts of process chemistry on donor quality and stability, on resid composition and conversion, and on product yields. The experiments were performed on a premixed 1:2 blend of Athabasca bitumen resid and a hydrotreated, refiner-derived, light cycle oil

(the donor). Runs were carried out under a wide range of severities to compare resid reactivity and results were interpreted using a simple first-order reaction model which defined a severity index in terms of reaction temperature and time. It was found that this model did not apply to resid conversion. The results could be explained by recogizing that the resid was not a single entity but consisted of 3 groups of components with very different reactivities. For the donor-refined bitumen, an optimum operational severity exists to produce a maximum liquid yield, while maintaining donor balance. Increasing severity did not improve resid conversion. High severities led to coke formation and gas production, the latter at the expense of liquid components. 10 refs., 3 tabs.

48199 (MIC–90-03191/XAB) **Testing of New Brunswick oil shale in R.P.C. test facility. Open File Report No. 90-2.** Salib, P.; Eng, P. New Brunswick Dept. of Natural Resources and Energy, Fredericton, NB (Canada). Minerals and Energy Div. ©1990. 104p. Source: NTIS, PC EE12/MF E01.

The oil shale deposits of the Albert Formation in the Moncton Subbasin, New Brunswick, are considered to be Canada's largest and highest grade oil shale reserves. The viability of N.B. oil shale would improve if it were utilized with other fossil fuel resources such as high sulphur N.B. coal. For this reason, one of the concepts under investigation is the possibility of adding a retort to the circulating fluidized bed unit of N.B. Power, located at Chatham, N.B. This report presents the results of retorting trials carried out on 2 oil shale samples from the Albert Formation. One sample is from the Albert Mines zone (32.4 Imp.Gal/short ton) and the other is from the Dolomite Marlstone Zone (10.9 Imp.Gal/short ton).

48200 **Fireflood ignition devices and methods.** Shallcross, D.C. (Melbourne Univ., Parkville (Australia). Dept. of Chemical Engineering). *In Situ (USA)*, 14(2): 147-174 (1990).

One of the most important tasks during a fireflood is to ensure the ignition of the oil-bearing stratum efficiently and safely. Many different devices have been developed and employed to achieve this aim. The target zone may ignite spontaneously upon injection of an oxygen-containing gas without the aid of special equipment. Alternatively, ignition may be hastened or enhanced by the use of gas-fired downhole burners, catalytic heaters, electric downhole heaters, or other, chemical means. Other methods involve increasing the reactivity of the formation contents by doping the stratum with compounds that ignite and burn more readily than the reservoir oil. This report surveys the range of ignition methods and devices that have been developed and applied in the field. Not only are successful ignition systems discussed, but also those designs that failed to ignite a formation. In discussing the various techniques, factors considered include reliability, specialized equipment and materials requirements, and safety.

0405 Properties and Composition

Refer also to citation(s) 48206, 48210, 48211

48201 (CU/FCE–CE03118, pp. 1-35, Paper 3) **A new analytical technique for the comprehensive characterization of oil sands: Reflectance spectroscopy.** Cloutis, E.A. (Univ. of Alberta, Endmonton, AB (Canada)). Calgary Univ., AB (Canada). Faculty of Continuing Education. 1990. (CONF-9003204–: 7. annual heavy oil and oil sands technical symposium, Calgary (Canada), 14 Mar 1990; CE–03118). In *Challenges and innovations 1990. Seventh annual heavy oil and oil sands technical symposium.* Source: Faculty of Continuing Education, University of Calgary, 2500 University Drive, N.W., Calgary, AB, CAN T2N 1N4. Prices: PRICES UPON REQUEST.

Recent investigation of the ultraviolet, visible and near infrared spectral reflectance properties of oil sands suggests that reflectance spectroscopy can provide information on diverse material properties. The characteristics amenable to spectral detection and analysis include the detection of metallo-porphyrins, detection and indentification of the various clay species, determination of free water, and the determination of bitumen abundances and constraints on the major types of organic molecules and bond types. The advantages of reflectance spectroscopy over other analytical techniques are many. The acquisition of reflectance spectra requires little or no sample preparation, thus textural relationships in samples can be preserved. In addition to the fact that the instrumentation is low cost, this technique has the potential to provide near-real time continuous material assays, something generally unavailable with other techniques. These factors also make spectroscopy an ideal candidate for incorporation into commercial operations which require rapid and/or continuous compositional information. Spectrometers installed in the process stream can provide uninterrupted and timely compositional information. Portable spectrometers are now available that will permit the characterization of core samples and exposures in the field. While reflectance spectroscopy may never completely supplant more conventional analytical techniques, it can at the least, serve as a useful analytical adjunct. The implications of reflectance spectroscopy for hydrocarbon analysis have yet to be fully explored, but the initial results indicate that it can be developed into a powerful analytical tool. Applications to liquid hydrocarbons are also considered. 81 refs., 9 figs., 3 tabs.

48202 (DOE/MC/11076–2851) **Formation of calcium and magnesium molybdate complexes in dilute aqueous solutions and evaluation of powellite solubility in spent oil shale.** Essington, M.E.; Huntington, G.S. Western Research Inst., Laramie, WY (USA). Feb 1990. 35p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC21-86MC11076. Order Number DE90009663. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In order to increase our understanding of the chemistry of molybdenum (Mo) in spent oil shale disposal environments, predict fate and behavior, and assess the effectiveness of proposed mitigation techniques, we feel that is imperative to understand the processes controlling Mo aqueous- and solid-phase distribution. Recent research supports the significance of alkaline earth and alkali metal ion pairs with molybdate in aqueous solutions. The objectives of this study were to measure the ion association constants (log Q) for the formation of calcium and magnesium molybdate ion pairs by potentiometric titration at pH 7 and 25°C in $NaNO_3$ ionic media. The measured values were then used to examine the equilibrium solubility of powellite ($CaMoO_4$) in KNO_3 solutions and spent oil shale systems. Powellite solubility data were evaluated using log Q for $CaMoO_4^0$ formation, resulting in a calculated log K_{sp} for powellite dissolution of -7.84. Application of an ion association model that used the molybdate ion pair formation data shows that spent oil shale leachates are undersaturated with respect to powellite. The results of this study show that molybdate ion pair formation in spent oil shale solutions may be significant and that soluble Mo concentrations may not be supported by powellite dissolution. 31 refs., 10 figs., 4 tabs.

0407 Health and Safety

Refer also to citation(s) 48200

0408 Economic, Industrial, and Business Aspects

48203 (CU/FCE–CE03118, pp. 1-14, Paper 8) **How to make money producing heavy oil?.** Farouq Ali, S.M. (Univ. of Alberta, Edmonton, AB (Canada)). Calgary Univ., AB (Canada). Faculty of Continuing Education. 1990. (CONF-9003204–: 7. annual heavy oil and oil sands technical symposium, Calgary (Canada), 14 Mar 1990; CE–03118). In *Challenges and innovations 1990. Seventh annual heavy oil and oil sands technical symposium.* Source: Faculty of Continuing Education, University of Calgary, 2500 University Drive, N.W., Calgary, AB, CAN T2N 1N4. Prices: PRICES UPON REQUEST.

Heavy oil and bitumen are low-priced hydrocarbons which are difficult to produce and to market, but are extremeley abundant in Alberta and Saskatchewan. The current state of the world oil market has meant that this resource is being sidetracked in favor of more attractive investments. Some of the problems related to heavy oil production in Canada are outlined, and partial solutions are suggested to increase the profitability of such operations. The first step in a heavy oil development is to determine whether a particular project is to be a pilot or commercial operation; whatever

the case, a long term commitment is needed. In the case of primary production, the typically low recovery rate (5-10% range) inhibits profitability, it is possible to develop practices unique to a given oil field in order to operate profitably. In the case of enhanced recovery, steam injection is generally used and a number of good candidates for such processes have been found. Fireflooding has been found largely uneconomical due to the operating cost and the unpredicatability of the process. Other procedures which may help to improve production include the relatively untested immiscible carbon dioxide process and the use of horizontal wells. Saving of energy through cogeneration, and recycling of produced water, have been successfully used in California fields to improve profitability and may have application elsewhere. 10 refs., 3 figs., 1 tab.

48204 (ST–88-43) **Alberta oil sands annual statistics, 1987.** Energy Resources Conservation Board, Calgary, AB (Canada). 1987. 31p. (CE–03148). Source: Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4. Prices: $20.00 CAN.

Annual and historical statistics are presented for production, supply, disposition, and processing of oil sands and related products at the Suncor and Syncrude plants in Alberta. The data for 1987 are shown on a monthly basis and include supply and disposition of synthetic crude oil, other hydrocarbons, coke, sulphur, bitumen, and distillate. Similar information is given in the historical section on a yearly basis back to 1979, plus a total for 1967-1978. 13 tabs.

0409 Waste Management

48205 (CU/FCE–CE03118, pp. 1-15, Paper 11) **Design criteria for produced sand injection facilities.** Cole, C.W. (Mobil Oil Canada, Lloydminister, AB (Canada)); Black, R.W. Calgary Univ., AB (Canada). Faculty of Continuing Education. 1990. (CONF-9003204–: 7. annual heavy oil and oil sands technical symposium, Calgary (Canada), 14 Mar 1990; CE–03118). In *Challenges and innovations 1990. Seventh annual heavy oil and oil sands technical symposium.* Source: Faculty of Continuing Education, University of Calgary, 2500 University Drive, N.W., Calgary, AB, CAN T2N 1N4. Prices: PRICES UPON REQUEST.

The disposal of sand separated from heavy oil production is becoming an increasingly critical problem in Canada. The large volumes of sand currently being produced and the potential environmental impact have demanded that practical and economical solutions to sand disposal are found. The need for novel methods to dispose of produced sand from heavy oil operations has been addressed by Mobil's new and innovative technique to dispose of sand using a cost effective and environmentally safe method. In this process, a slurry of sand and water are injected into an acceptable underground formation. A description of the facilities required for the process and their operation is provided. The process described in this paper is applicable to most heavy oil production areas in Alberta and Saskatchewan. The process has been tested a number of times and a review of the operating results from the recently installed, long-term test facility is provided. The design parameters for the test facility are also described along with a capital cost summary for the installation. 2 figs., 2 tabs.

48206 (DOE/MC/11076–2834) **Distribution of a crystalline nickel (II) porphyrin in the Green River Formation.** Mason, G.M.; Trudell, L.G.; Branthaver, J.F. Western Research Inst., Laramie, WY (USA). Sep 1989. 25p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC21-86MC11076. Order Number DE90009667. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Development of effective mitigation strategies for handling solid wastes from oil shale production requires knowledge of the types and the distribution of organic and inorganic phases. Characterization of the mineral phases of a resource is essential in order to improve retorting efficiency and maximize recovery, as well to dispose of the waste in an environmentally safe manner. Nickel is one of the metals considered by the United States Environmental Protection Agency to be of primary environmental concern. In the sediments of the Green River Formation, abelsonite, a nickel porphyrin, has been encountered in the raw oil shale. Because of its organo-metallic structure, abelsonite, when thermally processed, would be expected to contribute virtually all of its nickel to the process waste materials. It is the potential increase in nickel concentrations in spent shale that merits the investigation of the distribution of this material. 40 refs., 6 figs., 4 tabs.

0410 Environmental Aspects

Refer also to citation(s) 48202, 48734

48207 (PB–90-252065/XAB) **UNOCAL Parachute Creek Shale Oil Program. Environmental monitoring plan, annual report, October 1, 1988-September 30, 1989.** Unocal Corp., Parachute, CO (USA). Energy Mining Div. 31 Mar 1990. 82p. (REPT–90-1A). Source: NTIS, PC A05/MF A01.

See also PB–90-252073 and PB–89-191043.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic fuels plants. The Parachute Creek Shale Oil Program is one of four projects awarded financial assistance. The support agreement included development of an Environmental Monitoring Plan, incorporating existing compliance monitoring and supplemental monitoring on water, air, solid waste, worker health and safety, and socioeconomic impacts during the period 1986-1993. Phase I of the project is to produce 10,000 barrels per day of syncrude from oil shale, using the Unishale B process. A summary of monitoring 18 supplemental sites, including particulates, gases, liquids and solids is given. Results of Industrial Hygiene Supplemental Monitoring are discussed; no trends or relationships were evident in the data. Permit compliance and quality assurance/quality control activities are discussed.

48208 (RRTAC–89-2-Vol.2, pp. 575-578) **Current reclamation approach at the syncrude oil sands plant.** Dai, T.S. (Syncrude Canada Ltd., Fort McMurray, AB (Canada)); Fung, M.Y.P. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-31 Aug 1989; MICROLOG–90-03431). In *Proceedings of the conference Reclamation, a global perspective: Volume 2.* Source: PC Alberta Queen's Printer, Publications Office, 11510 Kingsway Ave, Edmonton, AB, CAN T5G 2Y5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

Syncrude Canada is an oil sands surface mining and processing venture located at the Athabasca Oil Sands deposit in northeastern Alberta. The Alberta Government maintains that mined land be reclaimed to an acceptable end land use with a capability equal to or better than that which was present prior to mining. An overview is of Syncrude's current land the mine overburden prestripping process, intensive sampling is conducted to assess the quality and volume of suitable reclamaton materials present. These materials are then used to cap the tailings sand and the overburden disposal piles to depths of 70 cm and 100 cm, respectively. Locally grown indigenous tree seedlings are then planted on the capping materials. When reclamation is completed, the final land form, made up of recontoured undulating topography, with improved internal soil water drainage and soil properties, is expected to be at least equal to the pre-disturbed state in terms of ecological capability. The plant communities will be permanent, self-supporting and maintenance-free.

48209 (RRTAC–89-2-Vol.2, pp. 687-694) **The effect of freezing and thawing on the dewatering of oil sands sludges.** Johnson, R.L. (Alberta Environmental Centre, Vegreville, AB (Canada)); Layte, P.; Bork, P. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-31 Aug 1989; MICROLOG–90-03431). In *Proceedings of the conference Reclamation, a global perspective: Volume 2.* Source: PC Alberta Queen's Printer, Publications Office, 11510 Kingsway Ave, Edmonton, AB, CAN T5G 2Y5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

Oil sands processing operations in northeastern Alberta generate 15 times $10^6 m^3$ of water-fines mixtures (sludge) per year. The fines settle in several weeks but will not consolidate to more than 35% solids, even over centuries. In an experimental study, freezing and thawing the oil sands sludge led to rapid dewatering. One cycle of freezing and thawing caused 15, 25, 35, and 45% solids sludge to reach 35, 39, 48, and 51% solids content, respectively. Subsequent freeze-thaw cycles, up to a total of three, caused less rapid increases in solids content. The maximum concentration of solids by freezing and thawing, even after repeated cycles, was 60%. The amount of dewatering due to freeze-thaw can be confidently predicted by knowing only the intial solids content. The freezing time for each sludge concentration was monitored to compute proportionality coefficients required to predict freezing depths under field conditions. 9 ref., 3 figs., 2 tabs.

0430 Transport, Handling, and Storage

48210 (DOE/PC/88951–5) **Determination of flow-regime boundaries for cohesive particles: Quarterly report, September 20–December 19, 1989.** Knowlton, T.M.; Findlay, J.G. Institute of Gas Technology, Chicago, IL (USA). Jul 1990. 33p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88951. Order Number DE90017259. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this work is to develop a hydrodynamic model capable of predicting the choking/non-choking flow regime boundary for cohesive solids. There are six tasks in this study: Preparation of a Project Work Plan, Hydrodynamic Model Development, Determination of Solid Rheological Properties of Oil Shale for Incorporation into the Hydrodynamic Model, Small-Scale Flow Tests, Large-Scale Flow Tests, and Comparison of Model with Data and Preparation of Final Report. Results to-date are discussed. 1 ref., 11 figs., 2 tabs.

48211 (DOE/PC/88951–6) **Determination of flow-regime boundaries for cohesive particles: Quarterly report, December 20, 1989–March 20, 1990.** Knowlton, T.M.; Findlay, J.G. Institute of Gas Technology, Chicago, IL (USA). Aug 1990. 42p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88951. Order Number DE90017258. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this work is to develop a hydrodynamic model capable of predicting the choking/non-choking flow regime boundary for cohesive solids. There are six tasks in this study: (1) Preparation of a Project Work Plan, (2) Hydrodynamic Model Development, (3) Determination of Solid Rheological Properties of Oil Shale for Incorporation into the Hydrodynamic Model, (4) Small-Scale Flow Tests, (5) Large-Scale Flow Tests, and (6) Comparison of Model with Data and Preparation of Final Report. Tests performed to-date are discussed. 1 ref., 18 figs., 2 tabs.

0440 Combustion

Refer also to citation(s) 48199

05 NUCLEAR FUELS

Refer also to citation(s) 49004

0504 Feed Processing

Refer also to citation(s) 48242, 48254

48212 (CDTN–432) **Comparison between the tricaprylylamine and trilaurilamine extrability in uranium and molybdenum extraction of low concentration liquors.** Duarte Neto, J.; Coelho, S.V. Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil). 1980. 11p. (In Portuguese). (CONF-8007153–: 4. Brazilian congress on chemical engineering, Belo Horizonte (Brazil), Jul 1980). Order Number DE91601482. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The extrability of trilaurilamine and tricaprylilamine in uranium and molibdenum extraction of sulfuric lixivium were studied and compared. The characteristics of solvent extraction, phase separation, emulsion formation and impurity interference were also determined. (C.G.C.).

48213 (IAEA-TECDOC–555, pp. 57-64) **Conversion of ore concentrates and reprocessed uranyl nitrate into UF_6.** Faron, R. (Comurhex, Courbevoie (France)). International Atomic Energy Agency, Vienna (Austria). May 1990. (CONF-8810509–: Technical committee on use of expert systems in nuclear safety, Vienna (Australia), 17 Oct 1988). In *Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988.* Order Number DE91602626. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

In France Comurhex, a subsidiary of Pechiney Group (51%) and Cogema (49%) started to convert ore concentrated into UF_6 at the beginning of the sixties. Since it began Comurhex has produced more than 100.000 T/U in UF_6 (Natural U) and almost 2000 T/U of reprocessed U from LWR irradiated fuel in a separate facility of its Pierrelatte Plant. During the same period also producing a large quantity of metal U for the French graphite gas power reactors. Comurhex production capacity for natural UF_6 has now risen to 14.000 T/U/year. Of the five converters in western countries four use the same process which is the wet process based on the purification of the feed material by the liquid/liquid exchange process. Only one uses the dry process with a purification in the last step using UF_6 distillation. In the future this process could be a handicap for the production of metal U to feed the AVLIS (SILVA) process. Firstly we will recall the main steps of the conventional wet process stressing the solid, liquid, and gas wastes produced at each step of the process. Secondly because Comurhex has the only large capacity for the recycling into UF_6 of reprocessed material, we will examine the different steps of this process and also we will have an overview of wastes treatments. One of the major target of conversion is to bring the uranium concentrate to the nuclear grade. Thus, all conversion processes generate a significant amount of waste. It is the convertor's duty to reduce the volume of waste and to handle them in a safe, efficient and economic manner. (author).

48214 (IAEA-TECDOC–555, pp. 183-197) **Spanish yellow cake production by bioleaching.** Josa, J.M. (Empresa Nacional de Uranio, Madrid (Spain)); Serrano, J.R. International Atomic Energy Agency, Vienna (Austria). May 1990. (CONF-8810509–: Technical committee on use of expert systems in nuclear safety, Vienna (Australia), 17 Oct 1988). In *Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988.* Order Number DE91602626. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

Eighty-seven percent of Spanish uranium production is obtained by bioleaching of the metamorphic shales of Salamanca. The deposit's paragenesis and mineralogy, with pitchblende and pyrite enrichening in the breccias and fissures are an optimum combination for direct attack of the pyrite by bacteria and the uranium's subsequent indirect leaching. The only acid which is introduced into the system is that used for conditioning the pregnant liquids before solvent extraction. Recycling (60-95%) of raffinates to leaching contributes sufficient acidity to have an optimum pH (2 - 2.6) for developing microorganisms. (author). 14 refs, 6 figs.

0505 Uranium Enrichment

Refer also to citation(s) 48249, 48250, 48251

48215 (EUR–12380) **The nuclear fuel cycle: review on R and D policies in the Member States of the European Communities.** Commission of the European Communities, Luxembourg (Luxembourg). 1989. 73p. Source: NTIS (US Sales Only), PC A04/MF A01.

This report presents an overview of the state of research in the field of the nuclear fuel cycle in the Member States of the European Communities. It covers the following steps of the fuel cycle: uranium enrichment, fuel fabrication, reprocessing, waste management and, in addition, decommissioning of nuclear facilities. Research carried out both in the public and private sectors has

been covered. However, information on the scope and volume of research carried out in the private sector is only in part available, as access to such information is difficult, in particular where it concerns activities which have a competitive commercial character.

48216 (K/ETO–34) **Gas-phase chemical reactivity of CFC-114 [Chloro-fluoro-carbons-114] and potential replacements: Part 1, CFC-114 reactivity with Fsub 2 and UFsub 6.** Trowbridge, L.D.; Angel, E.C.; Bostick, W.D. Oak Ridge Gaseous Diffusion Plant, TN (USA). Aug 1990. 34p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OT21400. Order Number DE91000134. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The DOE gaseous diffusion plant complex makes extensive use of CFC-114 as as primary coolant. As this material is on the Montreal Protocol list of materials scheduled for production curtailment, a substitute must be found. In addition to physical cooling properties, the gaseous diffusion application imposes requirements of chemical inertness to fluorinating agents that are somewhat unique. A series of studies has therefore been undertaken to evaluate the gas-phase chemical reactivity of potential alternate coolants. This report examines the reactivity of CFC-114 (i.e. $C_2F_4Cl_2$) with UF_6 and F_2. This degree of reactivity will serve as the baseline against which alternate coolants will be compared. 9 figs., 8 tabs.

0507 Fuels Production and Properties

Refer also to citation(s) 48215, 48872, 48883, 48994, 49710

48217 (CONF-900623–17) **Mechanistic interpretation of an observed rate dependence of low temperature swelling of irradiated uranium silicide dispersion fuels.** Rest, J.; Hofman, G.L. Argonne National Lab., IL (USA). Jun 1990. 21p. Sponsored by U.S. Arms Control and Disarmament Agency; U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-31109-ENG-38. From 15. symposium on effects of radiation on materials; Nashville, TN (USA); 17-21 Jun 1990. Order Number DE90017670. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Recent experimental observations on low temperature swelling of irradiated uranium silicide dispersion fuels have indicated that the growth of fission gas bubbles appears to be affected by fission rate. The swelling curve of the material exhibits a distinct "knee" that shifts to higher fission density with increased fission rate due to higher enrichments. Current state-of-the-art models for fission gas behavior do not predict such a dependence. Indirect evidence from various experiments leads the present authors to speculate that a dense network of subgrain boundaries forms at a dose corresponding to the "knee" in the swelling curve, upon which gas bubbles nucleate and then grow at an accelerated rate compared to those in the bulk material. A theoretical formulation is presented wherein the stored energy in the material is concentrated on a network of "crystallization" sites which diminish with dose due to interaction with radiation produced defects (vacancy-impurity pairs). Recrystallization is induced by statistical fluctuations when the energy per site is high enough such that the creation of grain boundary surfaces is offset by the creation of strain free volumes with a resultant net decrease in the free energy of the material. This formulation is shown to provide a reasonable interpretation of the observed phenomena. 11 refs., 7 figs.

48218 (CONF-9009256–1) **Kinetics of recrystallization and fission-gas induced swelling in high burnup UO_2 and U_3Si_2 nuclear fuels.** Rest, J.; Hofman, G.L. Argonne National Lab., IL (USA). Sep 1990. 35p. Sponsored by U.S. Department of Defense; U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-31109-ENG-38. From NATO advanced research workshop on fundamental aspects of inert gases in solids; Bonas (France); 16-22 Sep 1990. Order Number DE90017813. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Recent experimental observations on low-temperature swelling of irradiated uranium silicide dispersion fuels have indicated that the growth of fission gas bubbles appears to be affected by fission rate. The swelling curve of the material exhibits a distinct "knee" that shifts to higher fission density with increased fission rate due to higher enrichments. Current state-of-the-art models for fission gas behavior do not predict such a dependence. Grain "subdivision" has been observed in high burnup uranium oxide. This observation, and other indirect evidence from various experiments leads to authors to speculate that a dense network of grain boundaries forms in uranium silicide at a dose corresponding to the "knee" in the swelling curve; fission gas bubbles nucleate at the boundaries and then grow at an accelerated rate relative to those in the bulk material. A theoretical formulation is presented wherein the stored energy in the material is concentrated on a network of recrystallization sites that diminish with dose due to interaction with radiation-produced defects (vacancy-solute pairs). Recrystallization is induced by statistical fluctuations when the energy per site is high enough such that the creation of grain boundary surfaces is offset by the creation of strain-free volumes with a resultant net decrease in the free energy of the material. This formulation, applied within the context of a mechanistic treatment of gas bubble behavior, is shown to provide a plausible interpretation of the observed phenomena.

48219 **Low temperature routes to uranium nitrides.** Van Der Sluys, W.G. (Los Alamos National Laboratory, NM (USA)); Smith, D.C.; Paffett, M.T.; Sattelberger, A.P. pp. 78, Paper INOR 269 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

There are two well-characterized phases of uranium nitride, UN and U_2N_3, which can be prepared from the elements at elevated temperatures (550-1,300°C) and atmospheric pressure. We are investigating low-temperature routes to these phases and looking for new U_xN_y phases which may be unstable at elevated temperatures. Recent results from our laboratory on the chemical vapor deposition of UN from volatile uranium amide precursors at temperatures $\leq$250°C will be presented and discussed. We have also found that reactions of uranium amides with excess anhydrous ammonia in hexane provide insoluble, air-sensitive, amorphous brown powders which only contain uranium and nitrogen. We will discuss the characterization of these new materials by XPS, Auger and SEM and their relationship to the known binary phases.

48220 **Effects of water composition on the dissolution rate of UO_2 under oxidizing conditions.** Wilson, C.N. (Pacific Northwest Lab., Richland, WA (USA)); Gray, W.J. pp. 1431-1436 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC06-76RL01830. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses dissolution rates measured on crushed unirradiated UO_2 fuel pellet samples under oxidizing conditions using a flow-through testing method. Water compositions are explained. Experiments and their preliminary results are discussed as they apply to the potential disposal of spent nuclear fuel at the candidate Yucca Mountain repository site.

48221 **Development of a crud particle size distribution and its effect on cask source term and containment analyses.** Thornhill, C.K. (Pacific Northwest Lab., Richland, WA (USA)); Jordan, H.; Sanders, T.; Lake, W.H. pp. 1425-1430 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC04-76DP00789. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses spent pressurized-water reactor (PWR) and boiling-water reactor (BWR) fuel rods from three reactors that were examined by hot cell periscope, energy dispersive x-ray analysis, and scanning electron micrography. A complete particle size distribution development is described. Its' results are reported.

0508 Spent Fuels Reprocessing

Refer also to citation(s) 48215, 48243, 48388, 48579

48222 (BARC–1482) **Purification of degraded TBP solvent using macroreticular anion exchange resin.** Kartha, P.K.S.

(Bhabha Atomic Research Centre, Bombay (India). Fuel Reprocessing Div.); Kutty, P.V.E.; Janaradanan, C.; Ramanujam, A.; Dhumwad, R.K. Bhabha Atomic Research Centre, Bombay (India). 1989. 34p. Order Number DE91601488. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Tri-n-butyl phosphate (TBP) diluted with a suitable diluent is commonly used for solvent extraction in Purex process for the recovery of uranium and plutonium from irradiated nuclear fuels. This solvent gets degraded due to various factors, the main degradation product being dibutyl phosphoric acid (HDBP). A solvent cleanup step is generally incorporated in the process for removing the degradation products from the used solvent. A liquid-liquid cleanup system using sodium carbonate or sodium hydroxide solution is routinely used. Considering certain advantages, like the possibility of loading the resin almost to saturation capacity and the subsequent disposal of the spent resin by incineration and the feasibility of adopting it to the process, a liquid-solid system has been tried as an alternate method, employing various available macroreticular anion exchange resins in OH^- form for the sorption of HDBP from TBP. After standardizing the various conditions for the satisfactory removal of HDBP from TBP using synthetic mixtures, resins were tested with process solvent in batch contacts. The parameters studied were (1) capacity of different resins for HDBP sorption (2) influence of acidity, uranium and HDBP on the sorption behaviour of the latter (3) removal of fission products from the solvent by the resin and (4) regeneration and recycling of the resin. (author). 2 figs., 13 tabs., 17 refs.

48223 (BARC–1486) **Separation and purification of uranium product from thorium in thorex process by precipitation technique.** Ramanujam, A. (Bhabha Atomic Research Centre, Bombay (India). Fuel Reprocessing Div.); Dhami, P.S.; Gopalakrishnan, V.; Mukherjee, A.; Dhumwad, R.K. Bhabha Atomic Research Centre, Bombay (India). 1989. 41p. Order Number DE91601489. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A sequential precipitation technique is reported for the separation of uranium and thorium present in the uranium product stream of a single cycle 5 per cent TBP Thorex Process. It involves the precipitation of thorium as oxalate in 1M HNO_3 medium at 60-70degC and after filtration, precipitation of uranium as ammonium diuranate at 80-90degC from the oxalate supernatant. This technique has several advantages over the ion-exchange process normally used for treating these products. In order to meet the varying feed conditions, this method has been tested for feeds containing 10 g/l uranium and 1-50 g/l thorium in 1-6M HNO_3. Various parameters like feed acidities, uranium and thorium concentrations, excess oxalic acid concentrations in the oxalate supernatant, precipitation temperatures, precipitate wash volumes etc. have been optimised to obtain more than 99 per cent recovery of thorium and uranium as their oxides with less than 50 ppm uranium losses to ammonium diuranate filtrate. The distribution patterns of different fission products and stainless steel corrosion products during various steps of this procedure have also been studied. For simulating the actual Thorex plant scale operation, experiments have been conducted with 25g and 100g lots of uranium per batch. (author). 6 tabs., 8 figs., 22 refs.

48224 (CONF-901101–33) **The search for advanced remote technology in fast reactor reprocessing.** Burch, W.D.; Herndon, J.N.; Stradley, J.G. Oak Ridge National Lab., TN (USA). [1990]. 22p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. From American Nuclear Society winter meeting; Washington, DC (USA); 11-15 Nov 1990. Order Number DE91000398. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Research and development in fast reactor reprocessing has been under way about 20 years in several countries throughout the world. During the past decade in France and the United Kingdom, active development programs have been carried out in breeder reprocessing. Actual fuels from their demonstration reactors have been reprocessed in small-scale facilities. Early US work in breeder reprocessing was carried out at the EBR-II facilities with the early metal fuels, and interest has renewed recently in metal fuels. A major, comprehensive program, focused on oxide fuels, has been carried out in the Consolidated Fuel Reprocessing Program (CFRP) at the Oak Ridge National Laboratory (ORNL) since 1974. Germany and Japan have also carried out development programs in breeder reprocessing, and Japan appears committed to major demonstration of breeder reactors and their fuel cycles. While much of the effort in all of these programs addressed process chemistry and process hardware, a significant element of many of these programs, particularly the CFRP, has been on advancements in facility concepts and remote maintenance features. This paper will focus principally on the search for improved facility concepts and better maintenance systems in the CFRP and, in turn, on how developments at ORNL have influenced the technology elsewhere.

48225 (HW–72042) **Engineering study: Improved facilities for the removal of iodine-131 from Purex process vent off-gas.** Michels, L.R.; Zahn, L.L. General Electric Co., Richland, WA (USA). Hanford Atomic Products Operation. 2 Apr 1962. 29p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE90015354. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Declassified 22 Oct 1976.

For several years, HAPO has operated with a goal of discharging less than 10 curies of iodine-131 per week. During the first three quarters of 1961, iodine-131 emission averaged 5.4 curies per week and exceeded the 10 curie limit during only 3 weeks. Reduction of release to the target value of 2 curies per week average, or less, has been obtained recently by increasing average slug cooling time to about 140 days. Alternately, provision of new facilities for improved iodine retention would permit reduction of cooling time and recovery of inventory values. This report is intended to provide a general background on the performance of Purex iodine removal facilities to date, to present the process engineering of the suggested improvements to the process vent system and to outline future courses of action which would be helpful in reducing cooling time to avoid accumulation of large inventories of unprocessed irradiated fuel.

48226 **Consolidated fuel reprocessing program simulation of a continuous rotary dissolver.** Carnal, C.L. (Tennessee Technological Univ., Cookeville, TN (USA). Dept. of Electrical Engineering); Hardy, J.E.; Lewis, B.E. pp. 283-287 of Proceedings of the 1989 summer computer simulation conference. Clema, J.K. Society for Computer Simulation, San Diego, CA (USA) (1989). DOE Contract AC05-84OR21400. (CONF-890753–: 21. annual summer computer simulation conference, Austin, TX (USA), 24-27 Jul 1989).

This paper describes the simulation of a rotating, multistage chemical reactor that dissolves spent nuclear fuel for reprocessing in a breeder cycle. The continuous, time-dependent process model of a dissolver was developed using the Advanced Continuous Simulation Language (ACSL) to calculate various temperatures and the masses of the chemical constituents of the solution in each stage. Model simulation is presented.

48227 **Acceptance of spent fuel of varying characteristics.** Short, S.M. (Pacific Northwest Lab., Washington, DC (USA)). pp. 757-764 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC06-76RL01830. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper is an overview of a study with the primary objective of establishing a set of acceptance selection criteria and corresponding spent fuel characteristics to be incorporated as a component of requirements for the Federal Waste Management System (FWMS). A number of alternative acceptance allocations and selection rules were analyzed to determine the operational sensitivity of each element of the FWMS to the resultant spent fuel characteristics. Recommendations of the study include three different sets of selection rules to be included in the FWMS design basis.

48228 **Estimate of the source term for a repository surface facility from the routine processing of spent fuel.** Mishima, J. (Pacific Northwest Lab., Richland, WA (USA)); Olson, K.M. pp. 1132-1137 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE

Contract AC06-76RL01830. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper evaluates the potential for release of radioactive material from the proposed handling and processing of spent nuclear fuel in a surface facility for a geologic repository. Sources are examined. The principal contributors found in this assessment are presented.

0509 Transport, Handling, and Storage

Refer also to citation(s) 48295, 48350, 48365, 48366, 48367, 48370, 48371, 48381, 48382, 48383, 48385, 48387, 48526, 49170, 49171, 49172, 49173, 49174

48229 (CONF-901101–9) **Validation of scale-4 for LWR [Light Water Reactor] fuel in transportation and storage cask conditions.** Bowman, S.M. (Oak Ridge National Lab., TN (USA)); Parks, C.V.; Bierman, S.R. Oak Ridge National Lab., TN (USA). [1990]. 7p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. From American Nuclear Society winter meeting; Washington, DC (USA); 11-15 Nov 1990. Order Number DE90012948. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper presents the results of criticality calculations performed to validate the recently released SCALE-4 modular code system for light water reactor (LWR) fuel under various conditions typical of transportation and storage casks. The modifications in SCALE-4 include NITAWL-II, an updated version of the NITAWL code that performs resonance self-shielding calculations using the Nordeim Integral Treatment. In order to validate SCALE-4 with the new resonance self-shielding treatment, the CSAS4 control module was used to calculate the effective neutron multiplication factor (k_{eff}) via the BONAMI[3], NITAWL-II, and KENO V.a[4] codes. The cross section library used was the 27 group ENDF/B-IV library, which has been updated for use with NITAWL-II. 12 refs., 1 tab.

48230 (CONF-901101–10) **End effects in the criticality analysis of burnup credit casks.** Brady, M.C.; Parks, C.V. Oak Ridge National Lab., TN (USA). [1990]. 6p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC05-84OR21400. From American Nuclear Society winter meeting; Washington, DC (USA); 11-15 Nov 1990. Order Number DE90012942. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A study to evaluate the effect of axially dependent burnup on k_{eff} has been performed as part of an effort to qualify procedures to be used in establishing burnup credit in shipping cask design and certification. This study was performed using a generic 31-element modular cast-iron cask (wall thickness 33.1 cm) with a 1-cm-thick borated stainless-steel basket for reactivity control. Fuel isotopics used here are those of the 17 × 17 Westinghouse assemblies from the North Anna Unit 1 reactor. Virginia Power (VP) provided detailed spatial isotopics for the fuel assemblies in-core at beginning-of-cycle 5 (BOC-5) as generated from their PDQ analyses. Twenty-two axial planes were defined in the original VP data. The isotopics used in this study were for a 3.41 initial wt % ^{235}U and an average burnup of 31.5 GWd/MTU.

48231 (CONF-901101–27) **Reactor critical benchmark calculations for burnup credit applications.** Renier, J.P.; Parks, C.V. Oak Ridge National Lab., TN (USA). [1990]. 8p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC05-84OR21400. From American Nuclear Society winter meeting; Washington, DC (USA); 11-15 Nov 1990. Order Number DE90015535. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

In the criticality safety analyses for the development and certification of spent fuel casks, the current approach requires the assumption of "fresh fuel" isotopics. It has been shown that the removal of the "fresh fuel" assumption and the use of spent fuel isotopics ("burnup credit") greatly increases the payload of spent fuel casks by reducing the reactivity of the fuel. Regulatory approval of burnup credit and the requirements of ANSI/ANS 8.1 specify that calculational methods for away-from-reactor criticality safety analyses be validated against experimental measurements. Criticality analyses for low-enriched lattices of fuel pins using the "fresh fuel isotopics" assumption have been widely benchmarked against applicable critical experiments. However, the same computational methods have not been benchmarked against criticals containing spent fuel because of the non-existence of spent fuel critical experiments. Commercial reactors offer an excellent and inexhaustible source of critical configurations against which criticality analyses can be benchmarked for spent fuel configurations. This document provides brief descriptions of the benchmarks and the computational methods for the criticality analyses. 8 refs., 1 fig., 1 tab.

48232 (DOE/OR/00033–T441) **Transporting spent nuclear fuel: A framework for decision-making.** Yuracko, K.L. Massachusetts Inst. of Tech., Cambridge, MA (USA). ©Feb 1990. 370p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-76OR00033. Source: Massachusetts Institute of Technology.

This study explores whether a consensual decision-making approach could be effective for resolving disputes involving the transportation of spent nuclear fuel. Interviews with the key parties to the dispute, a questionnaire, and a review of recorded testimony comprise the source materials. Using this information, the parties' underlying objectives were identified, along with the specific issues in dispute. The objectives of each of the parties were combined into a composite objectives hierarchy, and performance measures were defined for evaluating the consequences of transportation-system alternatives. Measurable multiattribute value functions were assessed for: state, local, and Indian Tribal officials; electric utilities; environmental and public interest groups; the transportation industry; the US Department of Transportation and Nuclear Regulatory Commission; and the US Department of Energy. A computer model was developed to provide estimates of health and safety and economic impacts of the alternatives. Transportation-system alternatives were developed, and evaluated using the value functions. Some efficient alternatives were identified that each party might prefer to its best alternative to a negotiated agreement. The demonstration of the possible existence of preferred alternatives suggests that it may be possible to make agreements that are to the advantage of all parties. Some transportation-system designs are developed that could be used as a concrete starting point for actual negotiations.

48233 (EPRI-NP–6940) **NUHOMS modular spent-fuel storage system: Design, licensing and construction.** McLean, J.C. Electric Power Research Inst., Palo Alto, CA (USA); Carolina Power and Light Co., Raleigh, NC (USA). ©Aug 1990. 117p. Sponsored by U.S. DOE Radioactive Waste Management; Electric Power Research Institute. DOE Contract AC06-76RL01830. (PNL–7354). Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

Carolina Power & Light Company, the US Department of Energy, and the Electric Power Research Institute are participating in a cooperative program to demonstrate the NUHOMS (NUTECH Horizontal Modular Storage) System for storing spent nuclear fuel. This storage concept/design was developed by NUTECH Engineers, which is also participating in the project. The project involves the design, construction, and testing of three reinforced concrete storage modules and three stainless steel canisters at the H. B. Robinson Steam Electric Plant. Testing will focus on (1) the system's operating and fuel handling features, and (2) verification of the design basis of the thermal and shielding performance of the storage modules. As part of the project, NRC approval of the NUTECH Topical Report on NUHOMS has been obtained as well as issuance of a 10CFR Part 72 Materials License for the H. B. Robinson site. 6 refs., 13 figs., 22 tabs.

48234 (MIC–90-03515/XAB) **Scale-model simulation of impact of a rail-locomotive coupler on the irradiated-fuel transportation cask.** Zane, R.M.; Tulk, J.D. Ontario Hydro, Toronto, ON (Canada). Research Div. ©1989. 35p. Source: NTIS, PC EE07/MF E01.

Ontario Hydro has developed a transportation cask for large-scale shipments of irradiated fuel from CANDU reactors. This package was licensed for use on public highways by a series of 9-meter drop tests, in accordance with the Atomic Energy Control Board regulations for radioactive materials transport. The tests described go beyond the regulatory requirements and were designed

to simulate a collision between a freight locomotive travelling at 105 km/h (65 mph) and an irradiated fuel transport cask. The test was carried out to resolve the question of whether or not a stiff, blunt projectile - such as the coupler on a fast-moving train - could penetrate the wall of the cask. The test featured a 7th scale model of the cask striking a 7th scale model locomotive. To achieve the impact velocity, a small rocket motor was used to help accelerate the cask model.

48235 (MIC–90-03535/XAB) **Robotic inspection of prototype titanium diffusion-bond final-closure weld: Final report.** Piercy, R.J.; Antonacci, J.R.; Moles, M.D.C. Ontario Hydro, Toronto, ON (Canada). Research Div. ©1989. 24p. Source: NTIS, PC EE07/MF E01.

Description of the ultrasonic inspection of a prototype titanium diffusion bond for a nuclear used fuel container. A commercial industrial robot was used for the delivery system, controlled by a personal computer. The robot maps the container, then scans the container for defects.

48236 Radioactive materials packaging standards and regulations: Making sense of it all. Pope, R.B. (Oak Ridge National Lab., TN (USA). Chemical Technology Div.); Rawl, R.R. pp. 210-219 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC05-84OR21400. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper presents an overview of numerous regulations and standards, both national and international, that apply to the packaging and transportation of radioactive material. The identity and applicability of these requirements and the bodies that formulated them are discussed. The authors address the roles that various international bodies play in developing and implementing the various regulations and standards.

48237 The transportation operations system: A description. Best, R.E. (Science Applications International Corp., Oak Ridge, TN (USA)); Danese, F.L.; Dixon, L.D.; Peterson, R.W.; Attaway, C.R.; Pope, R.B.; Shappert, L.B.; Jones, R.H. pp. 265-272 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses a system engineering approach being applied to organize and develop relations among the people, hardware, and software of the Transportation Operations System (TOS), are described. TOS development objectives are included.

48238 Development of transportation operations requirements: Operations planning. Grady, S.T. (Science Applications International Corp., Oak Ridge, TN (USA)); Best, R.E.; Danese, F.L.; Peterson, R.W.; Pope, R.B. pp. 273-280 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses transport conditions at various utility sites that vary dramatically in terms of characteristics at and near the site, m requirements, administrative procedures, and other factors. The authors outline an approach that provides for an identification of specific sites, evaluation of shipment capabilities at each site, and integration of the sites into multi-site shipping campaigns to scope the logistics management problem for the transportation operations systems.

48239 Identification of facility constraints that impact transportation operations. Peterson, R.W. (Science Applications International Corp., Oak Ridge, TN (USA)); Pope, R.B. pp. 281-287 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper identifies and discusses the key reactor facility constraints that will eventually need to be assessed in detail on a site-specific basis to guide the development of the FWMS transportation cask fleet. The need for evaluation of constraints is discussed.

48240 Materials selection issues for structural components of transportation casks. Sorenson, K.B. (Sandia National Labs., Albuquerque, NM (USA)); Salzbrenner, R.; Stephens, J.J. Jr. pp. 765-770 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC04-76DP00789. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses an evaluation of the use of alternate materials as structural components in nuclear spent fuel transportation casks. Principle technical issues are addressed. Focus is on the appropriateness of brittle fracture criteria.

48241 Size and transportation capabilities of the existing U.S. cask fleet. Danese, F.L. (Science Applications, Inc., Oak Ridge, TN (USA)); Johnson, P.E.; Joy, D.S. pp. 1066-1073 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper investigates the current spent nuclear fuel cask fleet capability in the United States. It assesses the degree to which the current fleet would be available, as a contingency, until proposed Office of Civilian Radioactive Waste Management casks become operational. A limited fleet of ten spent fuel transportation casks is found to be readily available for use in Federal waste management efforts over the next decade.

0510 Economic, Industrial, and Business Aspects

Refer also to citation(s) 48311, 48313, 48322, 48344, 48364, 48377

48242 (IAEA-TECDOC–555) **Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988.** International Atomic Energy Agency, Vienna (Austria). May 1990. 214p. (CONF-8810509–: Technical committee on use of expert systems in nuclear safety, Vienna (Australia), 17 Oct 1988). Order Number DE91602626. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

At the Technical Committee Meeting on Economics of Low Enriched Uranium 14 papers were presented. A separate abstract was prepared for each of these papers. The five technical sessions covered several economic aspects of uranium concentrates production, conversion into uranium hexafluoride and uranium enrichment and the recycling of U and Pu in LWR. Four Panel discussions were held to discuss the uranium market trends, the situation of conversion industry, the reprocessing and the uranium market, the future trends of enrichment and the economics of LWRs compared with other reactors. Refs, figs and tabs.

48243 (IAEA-TECDOC–555, pp. 65-73) **A technical and economic comparison of the conversion of natural and oxide reactor reprocessed uranium.** Forsey, C.D. (British Nuclear Fuels plc, Preston, Lancashire (UK). Springfields Works); Williams, T. International Atomic Energy Agency, Vienna (Austria). May 1990. (CONF-8810509–: Technical committee on use of expert systems in nuclear safety, Vienna (Australia), 17 Oct 1988). In *Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988.* Order Number DE91602626. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The paper will examine the requirements for UF6 conversion of natural and reprocessed uranium. It will compare the design and operation of the projected BNFL ECHO reprocessed uranium conversion plant with existing natural uranium plant. Conversion of reprocessed uranium from oxide fuelled reactors gives rise to substantially higher gamma dose rates than with natural uranium, principally because of the effects of the daughter products of U-232. As a result substantial shielding, coupled with changes in handling methods, are needed. These effects are more pronounced with uranium that has been exposed to high burnup, long

pre-reprocessing cooling times or prolonged storage after reprocessing. Conversion of reprocessed uranium generates waste products and streams that are more highly active than those arising from natural uranium. These wastes need special attention or treatment; final disposal of the wastes is more demanding because of the higher inventory of radionuclides. A conversion plant handling reprocessed uranium will of necessity have a smaller throughput than one for natural uranium because of the relative sizes of the two markets. In addition the dimensions of some key items in a reprocessed plant are limited because of the need to accommodate U-235 assays in excess of 1%, requiring the entire plant to be designed and operated to avoid the chance of a criticality event. This lower throughput when compared with a natural plant adversely affects the unit costs. Variations in isotope concentrations between different batches and campaigns can lead to increased costs if the availability of the plant is reduced as a result. This effect depends on the economic judgement of the plant operator and the range of feed materials being processed. All of the effects will increase the costs of conversion of reprocessed compared to natural uranium. (Abstract Truncated)

48244 (IAEA-TECDOC–555, pp. 31-56) **Uranium resources and supply-demand projections.** Mueller-Kahle, E. (International Atomic Energy Agency, Vienna (Austria). Div. of Nuclear Fuel Cycle and Waste Management). International Atomic Energy Agency, Vienna (Austria). May 1990. (CONF-8810509–: Technical committee on use of expert systems in nuclear safety, Vienna (Australia), 17 Oct 1988). In *Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988.* Order Number DE91602626. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The WOCA uranium resource situation and the supply and demand projections for two time frames (-2005 and -2030) are discussed. Within this scope are included those uranium related activities which have an impact on current and future supply. These include total uranium exploration expenditures in WOCA countries, uranium exploration expenditures funded by consumer countries outside their territories and discovery costs. In addition, the development of known uranium resources, production and prices are shown. The supply projections are based on the concept of production capability but expectations on future production are included. Also for the period through 2035, the resource adequacy in relation to a demand projection is analysed. Natural uranium for nuclear fuel used in WOCA represents a sales volume of about US$ 2,000 million based on the estimated 1989 production of 34,000 t U and an assumed average sales price of US$ 57/kg U (US$ 22/lb U_3O_8). As stated in the Summary of presentations and panel discussions to this book, the total sales volume is equivalent to about 20% of the total fuel cycle market value. The following chapters present an overview on uranium resources and the most recent supply-demand projections, as well as related topics such as uranium exploration and price developments, which are essential for the understanding of the overall uranium resources situation and the future sources of supply. The principal references for this report are the periodic studies on uranium exploration, resources, supply and demand carried out and published by the IAEA and the Nuclear Energy Agency (NEA) of OECD. Due to the absence of data from CMEA Member States, the material presented in this report had to be limited to WOCA. (author). 9 refs, 14 figs, 8 tabs.

48245 (IAEA-TECDOC–555, pp. 75-84) **Economic aspects of the PNC process.** Yasuda, I. (Power Reactor and Nuclear Fuel Development Corp., Okayama (Japan). Ningyo Toge Works); Otomura, K.; Wakabayashi, S. International Atomic Energy Agency, Vienna (Austria). May 1990. (CONF-8810509–: Technical committee on use of expert systems in nuclear safety, Vienna (Australia), 17 Oct 1988). In *Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988.* Order Number DE91602626. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

In order to evaluate economic aspect of uranium conversion, we make a study on commercial plant which is assumed to be constructed in Japan and applied PNC-process. A discounted cash flow rate of return method is used. Profitability of the project is expressed in term of return on investment (ROI). The ROI is about 10% in the base case which is assumed to be 5,000 tU/y. Sensitivity analyses for some parameters of base case are performed. A value of one parameter is changed at a time and the corresponding change in ROI is estimated. Cost saving elements are studied on a small plant which is assumed to be constructed adjacent to the enrichment plant. (author). 4 refs, 10 figs, 1 tab.

48246 (IAEA-TECDOC–555, pp. 85-101) **The economics of uranium recycling in the LWR fuel cycle.** Leyser, E. (Deutsche Gesellschaft fuer Wiederaufarbeitung von Kernbrennstoffen mbH (DWK), Hannover (Germany, F.R.)). International Atomic Energy Agency, Vienna (Austria). May 1990. (CONF-8810509–: Technical committee on use of expert systems in nuclear safety, Vienna (Australia), 17 Oct 1988). In *Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988.* Order Number DE91602626. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

An exact assessment of the economics of uranium recycling in the LWR fuel cycle is a complex matter as it depends on many parameters and boundary conditions. However, the recycling of reprocessed uranium (REPU) can allow for substantial savings of natural uranium (NATU) and separative work as compared to a reactor refuelling scheme which only uses freshly enriched natural uranium. Commercial and financial impacts are partly subject to factors which cannot be influenced by users, and must be assessed by interested parties as a function of their specific conditions. For this reason, they are not further examined within the scope of this paper. There are several possibilities for the recycling of REPU, the most important being via re-enrichment, and the second by using it as a carrier for MOX fuel ($(U\text{-}Pu)O_2$ fuel). A third possibility is that of blending with enriched NATU. In the case of re-enrichment, the savings depend upon the quality of the REPU, mainly the residual enrichment and the ^{236}U content. The latter is very important as ^{236}U is a neutron poison, and for this reason, the REPU must be enriched to a higher degree than NATU fuel of equivalent reactivity. Based upon a 1300 MWe PWR power plant, the range of possible savings through the recycling of uranium and plutonium is assessed. The production of electric power by one tonne of NATU is calculated as a function of burnup as well as the corresponding productivity increase due to recycling. This shows to be within a range of about 30 to 40%. It will be up to the involved industry to ensure conditions which will allow for lower fuel cycle costs per kWh through recycling, as compared to the open cycle. (author). 8 figs.

48247 (IAEA-TECDOC–555, pp. 103-109) **Prospects for the French nuclear fuel management.** Presta, M. (Electricite de France (EDF)); Guiheux, J.M. International Atomic Energy Agency, Vienna (Austria). May 1990. (CONF-8810509–: Technical committee on use of expert systems in nuclear safety, Vienna (Australia), 17 Oct 1988). In *Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988.* Order Number DE91602626. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

In France, the present share of nuclear electricity generation is about 70 percent. In order to reduce fuel costs, EDF, the French utility, is dedicated to improve the management of the reloads for the 50 reactors it has to manage. Several decisions are now on the way. They affect the adjustment of the reloads to the situation of electricity consumption, the development of higher burn-up fuels and 1/4 reloads, and the recycling of reprocessing materials. It results that some new features in the management of the fuel cycle have been developed. That is why, COGEMA and other French fuel cycle companies have prepared some new processes to bring new solutions to the utility needs. First, new flexibilities have been created in the enrichment and fabrication management system in order to procure assemblies to EDF according to its needs with both right enrichment levels and fuel capabilities. Second, the recycling of reprocessing materials has been largely studied and large industrial facilities are now either operating or planned: they deal with conversions in UREP plants, enrichment of reprocessed uranium in EURODIF or by laser process, fabrication for REPU fuels by FRAGEMA or for MOX fuels by COMMOX. COGEMA relies on its experience acquired during the large French nuclear program

development that let the company to adapt flexibly to the various EDF fuel management improvements. With this background, COGEMA offers services to foreign customers as well. With all these new features, the French nuclear system is now on a good way to ensure a good transition from the phase of building and development to a phase of sophisticated management and optimized use of French nuclear industrial facilities in the next 20 years. (author). 3 figs.

48248 (IAEA-TECDOC–555, pp. 111-132) **Economics of the use of the Laguna Verde 2 initial core as reloads of Laguna Verde 1.** Villanueva, C. (Comision Federal de Electricidad, Mexico City (Mexico). Dept. de Ingenieria Nuclear); Ortega, R.; Sanchez, L. International Atomic Energy Agency, Vienna (Austria). May 1990. (CONF-8810509–: Technical committee on use of expert systems in nuclear safety, Vienna (Australia), 17 Oct 1988). In *Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988.* Order Number DE91602626. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The required 637 tons of natural U_3O_8 for both Laguna Verde units were delivered to USDOE, as UF_6, under a contract with CFE for that specific purpose. The enrichment of the uranium to an average level of 1.87% U235, that required 318 tons of separative work, was done between October of 1976 and May of 1978 by the United States Department of Energy (USDOE, ERDA up to 1976), under long term fixed commitment contracts signed with CFE, subsequent to a trilateral agreement for the supply of enriched uranium signed in 1974 between the Governments of Mexico and the United States, with the International Atomic Energy Agency (IAEA). Those contracts have now been converted into one utility services contract signed by CFE and USDOE in September of 1984. The fabrication of the 888 assemblies for both units, plus 3 spare assemblies, was done between January of 1978 and August of 1980 by General Electric, of the United States, under a contract with CFE, that also includes the supply of fabrication services for 592 reload assemblies for each unit. The initial load fuel assemblies arrived to the Laguna Verde site between May of 1979 and May of 1980, and have been in storage since then at a warehouse built for that purpose. Laguna Verde 1 is ready for fuel loading to the reactor, in July of 1988, but Laguna Verde 2 is not expected to load fuel before 1992. Due to this long delay there are strong incentives to use the fuel of Laguna Verde 2 as reloads of Laguna Verde 1, because by the time of initial fuel loading of the second unit, CFE can use more advanced fuel designs, that can achieve higher burnups with lower enriched fuel requirements, without decreasing the margins to thermal limits. Therefore, CFE has done incore and outcore fuel management studies to analyse the use of Laguna Verde 2 fuel in Laguna Verde 1 and has concluded that, from the safety, operational and economic point of view, is feasible.

48249 (IAEA-TECDOC–555, pp. 133-139) **Compared economic features of enrichment processes.** Coates, J.H. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). International Atomic Energy Agency, Vienna (Austria). May 1990. (CONF-8810509–: Technical committee on use of expert systems in nuclear safety, Vienna (Australia), 17 Oct 1988). In *Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988.* Order Number DE91602626. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

Several attempts made in the past have shown that comparing economic features of enrichment processes is a difficult endeavour. The separative work cost concept can be used as a guiding criteria, but other aspects are also important. Dealing solely with enrichment costs leads to qualify the various items which appear in the cost breakdowns of separative work delivered by various enrichment processes. Among these items, a broad distinction can be made between intrinsic characteristics of the processes (i.e. component sophistication, operating staff, energy consumption, material hold-up, etc.) and economic features or assumptions of a more general nature (costs of manpower; rates of return, energy, inflation, etc.). The paper briefly reviews these various aspects and points out some of the difficulties met in attempting comparisons: for instance, the processes under survey rarely attain the same state of development and the general economic backgrounds vary from one country to another. Moreover, differences appear when coping with a real plant project instead of a simple didactic exercise. Although it can hardly be quantified, the ability of the project's sponsoring team then becomes of prime importance. The conclusion of this short paper can only be expressed in very cautious terms. Attaining low enrichment costs is undoubtedly a stimulating challenge which every enrichment producer keeps in mind. But there are many ways to attain or maintain competitivity. Beyond such endeavours, one may simply express the wish to see fair pricing applied within a large and healthy enrichment market. (author). 2 figs, 1 tab.

48250 (IAEA-TECDOC–555, pp. 141-150) **Enrichment and fuel cycle developments.** Kehoe, R.B. (Urenco Ltd., Marlow (UK)). International Atomic Energy Agency, Vienna (Austria). May 1990. (CONF-8810509–: Technical committee on use of expert systems in nuclear safety, Vienna (Australia), 17 Oct 1988). In *Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988.* Order Number DE91602626. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

This contribution will outline the role of centrifuge enrichment in the low enriched uranium market. Introduced commercially in the early 1970s, the technology is firmly established and the process is being progressively advanced. It has capacity, flexibility and cost characteristics quite different from other processes and its ability to handle recycled uranium without cross-contamination is a notable feature. Co-ordinated operations in the three countries give further flexibilities and diversity of supply. The paper will review these matters and their economic implications. (author). 2 refs, 11 figs.

48251 (IAEA-TECDOC–555, pp. 151-159) **Economics of low enriched uranium in China.** Liu Qiaosheng (National Nuclear Industry General Corp., Beijing (China)); Wu Deming. International Atomic Energy Agency, Vienna (Austria). May 1990. (CONF-8810509–: Technical committee on use of expert systems in nuclear safety, Vienna (Australia), 17 Oct 1988). In *Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988.* Order Number DE91602626. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

A brief review about current state and developing tendency of different processes of the uranium enrichment industry is made and a description about the advantages and disadvantages of both GD and GC processes is also made. The comparison between and predictions of main economical indexes (specific capital cost, specific power consumption, the composition of unit cost of separative power, lifetime of the machine and construction period of the factory, etc.) of commercial low enriched uranium used for nuclear power stations produced by GD and GC is then made. The points of view are provided about how to select the industrial separative method of uranium isotope in different aspects. Finally, the measures of reducing unit cost per SWU of GD in China are also discussed. (author). 1 tab.

48252 (IAEA-TECDOC–555, pp. 161-170) **Low enriched uranium fuel in CANDU reactors.** Archinoff, G.H. (Ontario Hydro, Toronto, ON (Canada)). International Atomic Energy Agency, Vienna (Austria). May 1990. (CONF-8810509–: Technical committee on use of expert systems in nuclear safety, Vienna (Australia), 17 Oct 1988). In *Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988.* Order Number DE91602626. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

CANDU reactors currently operate on the once-through natural uranium fuel cycle. Current stations can, however, operate with enrichment levels up to about 0.9% U-235 without requiring major design changes. When the U-235 content of CANDU fuel is increased from 0.71% associated with natural fuel to 0.9% fuel burnup is doubled while the quantity of mined uranium required to produce a unit of electrical energy is reduced by 25%. Since the burnup is doubled, the number of fuel bundles required to produce a given amount of electrical energy is reduced by 50%. Although LEU fuel involves uranium enrichment as a new process in the fuel cycle, the additional cost of enrichment and possible increases in

fuel fabrication costs are more than offset by the increased burnup and the reduced used fuel handling requirements such that there is about a 25% overall reduction in fuelling costs. While the enrichment level of 0.9% does not require major design changes to the fuel or existing generating stations, it will have implications for the fuel cycle in the following areas: 1. Uranium mining - Annual mined uranium requirements will be reduced by about 25% over a period of about 10 years as stations are converted to LEU fuel. 2. Refining - Conversion of yellowcake to uranium dioxide will no longer be required. 3. Enrichment - This is a new step in the CANDU fuel cycle. 4. Conversion to uranium dioxide - Uranium hexafluoride enriched to 0.9% U-235 must be converted to uranium dioxide prior to fabrication into pellets. At present there is no facility in Canada which can perform this conversion on a production scale. 5. Fuel fabrication - The annual production rate of fuel bundles will be reduced by about 50%. 6. Used fuel management - The 50% reduction in used fuel bundle throughput will affect storage, transportation and disposal of used fuel. 7 refs, 4 figs.

48253 (IAEA-TECDOC–555, pp. 171-181) **Uranium: The recalcitrant commodity.** Crowson, P.C.F. (Rio Tinto Zinc Corp. plc, London (UK)). International Atomic Energy Agency, Vienna (Austria). May 1990. (CONF-8810509–: Technical committee on use of expert systems in nuclear safety, Vienna (Australia), 17 Oct 1988). In *Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988.* Order Number DE91602626. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The uranium is analysed as a special market commodity and compared with other metals like copper. The supply-demand balance, production costs and the special form of pricing are discussed. The likely evaluation of inventories and the future capacity utilization are also discussed and commented. (author). 2 refs, 8 figs.

48254 (IAEA-TECDOC–555, pp. 199-209) **A study on the recovery of uranium from low grade vein deposits.** Josa, J.M. (Empresa Nacional de Uranio, Madrid (Spain)); Serrano, J.R. International Atomic Energy Agency, Vienna (Austria). May 1990. (CONF-8810509–: Technical committee on use of expert systems in nuclear safety, Vienna (Australia), 17 Oct 1988). In *Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988.* Order Number DE91602626. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The Saelices el Chico "Fe" mine deposit has been open pit mined and heap leached over the years, with a maximum production of 230 t of U_3O_8, although with low recovery (60 - 70%). Its reserves are about 9,000 t of U_3O_8. Nearby, there are other deposits of the same type up to a total of 20,000 t of U_3O_8. The existing amount of uranium could justify its economic recovery in a conventional plant producing some 1,000 t of U_3O_8 with a greater yield than that from heap leaching. However, the low grade, 600 - 800 g of U_3O_8/t, is an unfavourable aspect for its economic feasibility. ENUSA has carried out many studies for the last years with a view to its evaluation. It has seen that a preconcentration stage can be used due to the differentiation existing between mineralisation (soft and loose) and the hard, compact host rock. Crushing to 100 mm and classifying to 1-2 mm, most of the uranium goes to the fine fraction to be fed to a conventional acid plant. The low grade coarse solids will be attacked by heap leaching. The unit's yield and economy could be compatible with market conditions. (author). 13 refs, 5 figs, 2 tabs.

0520 Waste Management

Refer also to citation(s) 48215, 48233, 48376, 48377, 48378, 48379, 48380, 48384, 48386, 48726, 48729, 48981, 48982, 48991, 49174, 49175, 49459, 49516, 49548, 49572, 49577, 49578, 49579, 49594, 49596, 49597, 49598, 49609, 49734, 49737

48255 (ANL/EAIS/TM–24) **Identification and estimation of socioeconomic impacts resulting from perceived risks and changing images: An annotated bibliography.** Nieves, L.A.; Wernette, D.R.; Hemphill, R.C.; Mohiudden, S.; Corso, J. Argonne National Lab., IL (USA). Environmental Assessment and Information Sciences Div. Feb 1990. 126p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE90018004. Source: NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

In 1982, the US Congress passed the Nuclear Waste Policy Act to initiate the process of choosing a location to permanently store high-level nuclear waste from the designated Yucca Mountain, Nevada, as the only location to be studied as a candidate site for such a repository. The original acts and its amendments had established the grant mechanism by which the state of Nevada could finance an investigation of the potential socioeconomic impacts that could result from the installation and operation of this facility. Over the past three years, the Office of Civilian Radioactive Waste Management (OCRWM or RW) in the US Department of Energy (DOE) has approved grant requests by Nevada to perform this investigation. This report is intended to update and enhance a literature review conducted by the Human Affairs Research Center (HARC) for the Basalt Waste Isolation Project that dealt with the psychological and sociological processes underlying risk perception. It provides addition information on the HARC work, covers a subsequent step in the impact-estimation process, and translates risk perception into decisions and behaviors with economic consequences. It also covers recently developed techniques for assessing the nature and magnitude of impacts caused by environmental changes focusing on those impacts caused by changes in perceived risks.

48256 (ANS-R–678-1) **Assessment of the agricultural implications of land burial of radioactive wastes: soil processes.** Cramp, T.J.; Smith, A.D. Associated Nuclear Services, Epsom (UK). Jul 1987. 24p. Source: Available from A.N.S., Eastleigh House, 60, East St., Epsom, Surrey KT17 1HB, price Pound 15.00.

This report describes the results of work undertaken on the general subject of radionuclide transport from groundwaters via sub-soils to agricultural topsoil. Results of a review of soil-type dependent data are presented and are used to derive a new version of the model, WATCHEM, which also incorporates diffusion of nuclides between soil layers. This new version of the code, WATCHEM 2.0, has been subject to a variety of test runs on various computing systems, illustrative results of which are presented. The original version of the code is available as a 'stand-alone' module on the MAFF Prime whilst WATCHEM 2.0 is available to Ministry staff as an option within the SPADE 2.0 code. (author).

48257 (CONF-900579–2) **The TRansUranium EXtraction (TRUEX) process: A vital tool for disposal of US defense nuclear waste.** Horwitz, E.P.; Schulz, W.W. Argonne National Lab., IL (USA). [1990]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Seminar on new separation chemistry for radioactive waste and other specific applications; Rome (Italy); 13-18 May 1990. Order Number DE90017802. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The TRUEX (TRansUranium EXtraction) process is a generic actinide extraction/recovery process for the removal of all actinides from acidic nitrate and chloride nuclear waste solutions. Because of its high efficiency and flexibility and its compatibility with existing process facilities, TRUEX has now become a vital tool for the disposal of certain US defense nuclear waste. The development of TRUEX is closely coupled to the development of bifunctional extractants belonging to the carbamoylphosphoryl class and CMPO in particular. A brief review of the development of CMPO and its relationship to other bifunctional and monofunctional extractants is presented. The effect of TBP on CMPO, the selectivity of CMPO for actinides extracted from acidic nitrate media, the influence of diluents on CMPO behavior and 3rd phase formation, and the radiolysis/hydrolysis of CMPO and subsequent solvent cleanup will be highlighted. Application of TRUEX in the chemical pretreatment of specific nuclear waste streams and a summary of the current status of development and deployment of TRUEX is presented. 15 refs., 10 figs., 3 tabs.

48258 (CONF-900694–1) **Waste management aspects of the Formerly Utilized Sites Remedial Action Program.** Devgun, J.S. Argonne National Lab., IL (USA). [1990]. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From

11. annual meeting of the Canadian Radiation Protection Association; Saint John (Canada); 11-13 Jun 1990. Order Number DE90017678. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The remedial actions at the 31 sites that are currently in the Formerly Utilized Sites Remedial Action Program could genetic an estimated total volume of about 1.7 million cubic yards of radioactive waste, roughly equivalent to the total volume of low-level waste that has been disposed of at all the commercial disposal sites in the United States so far. The success of the program depends not only on remediating these sites but also on finding a permanent disposal place for the wastes. The disposal site options include existing Department of Energy reservations, commercial disposal sites, and new disposal sites. It may be necessary to develop new disposal facilities for these wastes because of several factors related to geographical location, transportation cost, environmental impacts, and sociopolitical considerations. Waste disposals is currently estimated to represent about one-third on the total estimated one billion dollar cost for the whole program. Waste management aspects within the program are diverse. The sites range in size from small sites used only for storage operations to large-scale decommissioned industrial facilities where uranium processing and other operations were carried out in the past. Currently, three sites are on the National Priorities List for remediation. 8 refs.

48259 (CONF-9006270–1) **Environmental impact assessment for a radioactive waste facility: A case study.** Devgun, J.S. Argonne National Lab., IL (USA). [1990]. 25p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From IAIA '90 conference; Lausanne (Switzerland); 26-30 Jun 1990. Order Number DE90017662. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A 77-ha site, known as the Niagara Falls Storage Site and located in northwestern New York State, holds about 190, 000 m^3 of soils, wastes, and residues contaminated with radium and uranium. The facility is owned by the US Department of Energy. The storage of residues resulting from the processing of uranium ores started in 1944, and by 1950 residues from a number of plants were received at the site. The residues, with a volume of about 18,000 m^3, account for the bulk of the radioactivity, which is primarily due to Ra-226; because of the extraction of uranium from the ore, the amount of uranium remaining in the residues is quite small. An analysis of the environmental impact assessment and environmental compliance actions taken to date at this site and their effectiveness are discussed. This case study provides an illustrative example of the complexity of technical and nontechnical issues for a large radiative waste facility. 11 refs., 7 figs., 2 tabs.

48260 (DOE/AL/31950–T3) **Waste Isolation Pilot Plant site specific plan: Revision 2.** Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div. Jun 1990. 35p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-86AL31950. Order Number DE90017784. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Utilizing the Department of Energy's (DOE) Environmental Restoration and Waste Management (ER/WM) Five-Year Plan (FYP), dated August 1989 as a basis, this document focuses on FY 1990 activities and provides preliminary projections of activities for the ER/WM progress for FY 1991 through FY 1995. Individuals outside the DOE should focus their review of this document on an evaluation of the FYP planning and implementation process. Evaluation of specific program scope, schedules, and costs should utilize the revised DOE ER/WM FYP, dated July 1990 and the specific installation's Activity Data Sheets available at public reading rooms, located near each DOE installation. This is the first in a series of annual Site Specific Plans (SSP) that will follow the Department of Energy's annual Environmental Restoration and Waste Management Five-Year Plan.

48261 (DOE/EA–0333) **Decontamination and decommissioning facility environmental assessment, Feed Materials Production Center, Fernald, Ohio.** Department of Energy, Oak Ridge, TN (USA). Oak Ridge Operations Office. Aug 1988. 110p. Sponsored by U.S. DOE Environment Health & Safety. Order Number DE90016205. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The Feed Materials Production Center (FMPC) is a US Department of Energy (DOE) uranium metal production facility located on a 425-hectare site near Fernald, Ohio. Operations at the FMPC result in radioactive contamination of tools, scrap materials, equipment and vehicles used in materials transport. Items requiring decontamination range from small hand tools to large pieces of machinery and bulk containers used for transporting uranium-bearing powders. At the present time, only a small decontamination and decommissioning (D&D) facility is in operation at the FMPC. The existing facility is inadequate to handle current and future operational needs in an environmentally acceptable manner. In recognition of the inadequacy of the existing facility and in anticipation of expanded future requirements, the DOE proposes to construct a new D&D facility at the FMPC as part of the Environmental, Health and Safety Improvements project. The proposed facility is intended to provide for a variety of cleaning and decontamination processes. The types of materials expected to be treated in the facility include the following: contaminated scrap metal, vehicles, reusable equipment, T-hoppers, and furnace pots. This document discusses the proposed action, the alternatives, the affected environment, the environmental consequences, mitigation measures and persons and organizations consulted. 57 refs., 6 figs., 11 tabs.

48262 (DOE/EA–0338) **Thorium handling environmental assessment, Feed Materials Production Center, Fernald, Ohio.** Department of Energy, Oak Ridge, TN (USA). Oak Ridge Operations Office. Jan 1988. 98p. Sponsored by U.S. DOE Environment Health & Safety. Order Number DE90016204. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The US Department of Energy (DOE) has prepared an Environmental Assessment (EA) for a proposed project to remove, repackage, and temporarily store a portion of the thorium inventory at the Feed Materials Production Center (FMPC) located near Fernald, Ohio, as part of the overall environment, health, and safety improvements project of the FMPC facilities. The thorium materials considered here currently are stored at the FMPC site in a silo and a bin. Engineering analyses indicated that the storage silo was vulnerable to failure caused by natural meteorological or seismic phenomena; thus the silo and its supports were structurally reinforced to comply with current building codes. While the current storage method does not pose an immediate radiation hazard to human health or the environment, beyond the near vicinity of the silo and bins, the project is proposed to minimize the risk of a release of thorium materials. 57 refs., 9 figs., 7 tabs.

48263 (DOE/RL–90-17) **Nonradioactive dangerous waste landfill closure/postclosure plan.** USDOE Richland Operations Office, WA (USA). Aug 1990. 661p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. Order Number DE90017726. Source: NTIS, PC A99/MF A01 - OSTI; GPO Dep.

This document describes the activities for closure and postclosure care of the Nonradioactive Dangerous Waste Landfill (NRDWL) operated by the US Department of Energy-Richland Operations Office (DOE-RL) and co-operated by the Westinghouse Hanford Company (Westinghouse Hanford). The NRDWL is a land disposal unit located on the Hanford Site that has received dangerous waste of the type regulated under Washington State Department of Ecology (Ecology) Dangerous Waste Regulations, Washington Administrative Code (WAC) 173-303 (1989) from Hanford Site operations from 1975 through 1985. The NRDWL is designated for closure under RCRA regulations in accordance with the Hanford Federal Facility Agreement and Consent Order. Attached to the Hanford Federal Facility Agreement and Consent Order is an action plan that lists the RCRA treatment, storage, and/or disposal (TSD) units subject to permitting and closure and identifies the required activities and schedules. 100 refs., 47 figs., 20 tabs.

48264 (DOE-RW–89.106(v.1)) **VANDAL user guide. V. 1.1: input and execution (VANDAL version 1.1).** Unsworth, M.D. (Scicon Ltd., Milton Keynes (UK)). Department of the Environment, London (UK). Feb 1989. 95p. Contract PECD-7/9/362. (SCI-UD–18). Order Number DE90640167. Source: NTIS (US Sales Only), PC A05/MF A01; OSTI; INIS.

This document forms Volume 1.1 of the VANDAL User Guide and is intended to provide all the information necessary to define and run a case study. Information is given on the data to be specified, on the structure of the input data files and on how to execute the system. There are three related volumes to this, they are: Volume 1.2 - Input and Execution Appendices; Volume 2.1 - Ouput and Error Messages; and Volume 2.2 - PRA Output Analysis. (author).

48265 (DOE-RW–89.106(v.2)) **VANDAL user guide. V. 1.2: Input and execution appendices (VANDAL version 1.1).** Unsworth, M.D. (Scicon Ltd., Milton Keynes (UK)); Nancarrow, D.; Taylor, J. Department of the Environment, London (UK). Feb 1989. 189p. Contract PECD-7/9/362. (SCI-UD–19). Order Number DE90640168. Source: NTIS (US Sales Only), PC A09/MF A01; OSTI; INIS.

This document forms Volume 1.2 of the VANDAL User Guide and consists of the appendices to Volume 1.1. The appendices include sampling identifiers (coded names), and data item descriptions. (author).

48266 (DOE-RW–89.106(v.3)) **VANDAL user guide. V. 2.1: Output and error messages (VANDAL version 1.1).** Unsworth, M.D. (Scicon Ltd., Milton Keynes (UK)). Department of the Environment, London (UK). Feb 1989. 58p. Contract PECD-7/9/362. (SCI-UD–20). Order Number DE90640169. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

This document forms Volume 2.1 of the VANDAL User Guide and is intended to provide information on the output produced by the VANDAL system. The user is informed of the output data produced, the structure of the output files, and of the error messages which the system may output. There are three related volumes to this document, they are: Volume 1.1 - Input and execution; Volume 1.2 - Input and Execution Appendices; and Volume 2.2 - PRA Output Analysis. (author).

48267 (DOE-RW–89.107) **VANDAL technical overview: VANDAL version 1.1.** Unsworth, M.D. (Scicon Ltd., Milton Keynes (UK)). Department of the Environment, London (UK); Associated Nuclear Services, London (UK); CAP Scientific Ltd., London (UK); Electrowatt Engineering Services Ltd., London (UK); RM Consultants, Abingdon (UK). Jul 1989. 66p. Contract PECD-7/9/362. (SCI-TR–41). Order Number DE91602616. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

This document is concerned with the technicalities of the VANDAL code and covers the technical details of each of the systems modules in turn. Covered are SAMPLING, FLOW, VAULT, GEOSPHERE, BIOSPHERE and TIMESTEPPING. (author).

48268 (DOE/RW–0207) **Environmental program overview for a high-level radioactive waste repository at Yucca Mountain.** USDOE Nevada Operations Office, Las Vegas, NV (USA). Yucca Mountain Project Office. Dec 1988. 59p. Sponsored by U.S. DOE Radioactive Waste Management. Source: Free from OSTI.

The United States plans to begin operating the first repository for the permanent disposal of high-level nuclear waste early in the next century. In February 1983, the US Department of Energy (DOE) identified Yucca Mountain, in Nevada, as one of nine potentially acceptable sites for a repository. To determine its suitability, the DOE evaluated the Yucca Mountain site, along with eight other potentially acceptable sites, in accordance with the DOE's General Guidelines for the Recommendation of Sites for the Nuclear Waste Repositories. The purpose of the Environmental Program Overview (EPO) for the Yucca Mountain site is to provide an overview of the overall, comprehensive approach being used to satisfy the environmental requirements applicable to sitting a repository at Yucca Mountain. The EPO states how the DOE will address the following environmental areas: aesthetics, air quality, cultural resources (archaeological and Native American components), noise, radiological studies, soils, terrestrial ecosystems, and water resources. This EPO describes the environmental program being developed for the sitting of a repository at Yucca Mountain. 1 fig., 3 tabs.

48269 (EPRI-NP–6934) **Solidification in cement of ion-exchange resins from LOMI [Low Oxidation State Metal Ion] decontamination: Final report.** Electric Power Research Inst., Palo Alto, CA (USA); Bishop (J.V.), Midland, MI (USA). ©Aug 1990. 42p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

Chemical decontamination of operating nuclear power plants is performed to remove radioactive metal oxides from pipes and equipment thereby reducing the radiation exposure to personnel performing inspection and maintenance. The LOMI (Low Oxidation State Metal Ion) process is widely used to perform this decontamination. At the end of the decontamination operations, the chemicals remaining in solution are removed by ion exchange resins. The resins are subsequently solidified in metal liners using cement, transported and buried at an approved burial site. The work covered by this report was undertaken because of an incomplete solidification of the ion exchange resins. The details of the decontamination operations have been described. At the time the problem arose, a preliminary investigation led to the conclusion that the unsolidified resin resulted from inadequate mixing caused by the formation of hydrated gel. The purpose of this project was to develop an understanding of the variables affecting the formation of the gel and to devise methods to avoid its formation. Additionally, safe limits would be defined that would assure the complete solidification in cement of ion exchange resins used in LOMI chemical decontaminations. 5 refs., 3 figs., 6 tabs.

48270 (EUR–12216) **Application of ADINAT/ADINA and MINIMEF codes to the resolution of the different exercises of COSA project.** Commission of the European Communities, Luxembourg (Luxembourg). 1989. 61p. (In Spanish). Contract No. N FI1W/0218-EN. Source: NTIS (US Sales Only), PC A04/MF A01.

This report deals with the activities developed by the working group of the Escuela Tecnica Superior de Ingenieros de Minas de Madrid (E.T.S.I.M.M.) in collaboration with ENRESA within the framework of COSA project organised by the CEC. The ENRESA/ETSIMM working group became involved in the project under contract with the CEC the beginning of the phase named COSA II. For this reason it has been necessary to intensify the efforts in order to carry out, whithin the time available, the benchmarks corresponding to the previous phase COSA I. In this sense, the experience and results obtained by other european groups participating in the project, have proved to be very useful. The benchmarks cases for the different exercises were solved using the commercially available code ADINAT/ADINA and also the code developed by ETSIMM from the code named MINIMEF. In this report, in first place, a brief description of MINIMEF code is presented. A description of ADINA/ADINAT codes has not been included as these codes are well known. Next, the different benchmarks used, shall be described. The first two belong to the COSA I exercise while the latter is the one solved in the COSA II phase. All the results showed satisfactory as compared with those obtained by other working groups.

48271 (EUR–12290) **Setting up and experimental validation of the coupling between a geochemical model and a transport model of dissolved elements.** Vinsot, A. (Ecole Nationale Superieure des Mines, 77 - Fontainebleau (FR). Centre d'Information Geologique); Coudrain-Ribstein, A. Commission of the European Communities, Luxembourg (Luxembourg). 1989. 102p. (In French). Contract FI1W/0075-F. Source: NTIS (US Sales Only), PC A06/MF A01.

This report deals with the work undertaken by the Centre d'Informatique Geologique from l'Ecole des Mines de Paris (CIG), in the framework of a shared cost contract between the Commissariat a l'Energie Atomique (IPSN/DAS) and the Commission of the European Communities. The subject of this work is the modelling of the transfer of elements which are chemically sensitive to the geological medium. The aim is to substitute a description of geochemical phenomena for empiric laws for the study of the global partition of an element between aqueous phase and solid phase. Experimental work has been carried out by the Departement d'Etudes et de Recherches en Securite of the CEA in Cadarache (IPSN/DAS). The schedule of this work has been set up by mutual agreement between the IPSN/DERS, the CIG and the IPSN/DAS. Mathematical codes used for the interpretation of the experiments have been set up in the CIG. Among the eleven carried out experiments, some raise interpretation difficulties. To overcome these difficulties, some additional experiments and chemical analyses were done. Some experimental improvements could be amended

for: - the heating experiments - the chemical analysis of water samples. It appears from this study that the validation approach of a coupled code with help of flow through experiments needs several iterations and this stage makes up the first one.

48272 (EUR–12297) **Hydrothermal alterations as natural analogues of radionuclide migration in granitic rocks.** Piantone, P. (Bureau de Recherches Geologiques et Minieres (BRGM)). Commission of the European Communities, Luxembourg (Luxembourg). 1989. 205p. (In French). Contract FI1W/0072-F. Source: NTIS (US Sales Only), PC A10/MF A01.

The document is the final report of the project Hydrothermal alteration systems as analogues of nuclear waste repositories in granitic rocks which was the subject of contract n^0 F1 1 W/0072-F (CD) performed at shared cost between the Bureau de Recherches Geologiques et Minieres (BRGM), the Commissariat a l'Energie Atomique and the Commission of the European Communities as part of the MIRAGE programme. This study is the continuation of a preliminary study made by BRGM in 1986 and which concerned the same programme. The data given in this report were obtained from the study of the infilling and hydrothermalized walls of a mineralized vein located at Fombillou, Lot Department, in the French Massif Central. A satisfactory model of the processes generated by hydrothermal alteration then by climatic weathering such as formation of new minerals, flow of elements and variations in volume, was thus built. The mobility of elements displaying physical and chemical properties similar to those of radionuclides present in high-level radioactive waste was studied. A preliminary thermodynamic simulation of mineral transformations and transfers of matter during hydrothermal alteration was performed using the calculation code CEQCSY (Chemical EQuilibrium in Complex SYstem). This simulation is based on the values of the main physical and chemical parameters deduced from the analysis of the natural system. On the basis of the results obtained from Fombillou, an appraisal was made of the response of the granitic environment which has been disturbed by a hydrothermal system produced by heat emitted by the storage of high-level radio-active waste as well as its potential capacities of retention in case of possible leakage.

48273 (EUR–12299) **CEQCSY: a new code for chemical equilibrium calculation in multiphased systems.** Lehmann, J. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)); Fabriol, R. Commission of the European Communities, Luxembourg (Luxembourg). 1989. 36p. (In French). Contract FI1W/0072 and FI1W/0077. Source: NTIS (US Sales Only), PC A03/MF A01.

As part of the CEC Chemval/mirage project, a method is presented for calculating the thermodynamic equilibrium state of a multiphase system, by minimizing its Gibbs free energy constrained by mass balances. Compared to the other algorithms available in the literature, the method has three main characteristics: - the sets of equations corresponding to the conditions of homogeneous and heterogeneous equilibria are simultaneously solved, - a mathematical criterion for bringing a new multicomponent phase in the system is rigorously demontrated. - It enables a detailed representation of the multisite solid solutions with constraints called site closure relation. The code CEQCSY (Chemical Equilibrium in Complex SYstem) uses this formalism, and works with the thermodynamic data base from the EQ3/6 code. This choice makes easier several compared tests with EQ6: quartz dissolution in water, water-atmospheric air equilibrium, theoretical re-equilibrium of seawater, hydrothermal alteration of granite including solid solutions. The test results demonstrate the high efficiency and velocity of the code CEQCSY, when working on equilibrium state of multiphase systems. This high velocity was the aim of this work, in order to couple with thermic, hydrodynamic or mechanic codes.

48274 (EUR–12303) **Modified sulphur cement: A low porosity encapsulation material for low, medium and alpha waste.** van Dalen, A. (Netherlands - Energy Research Foundation, Petten (NL)); Rijpkema, J.E. Commission of the European Communities, Luxembourg (Luxembourg). 1989. 155p. Contract FI 1W-0008-NL. Source: NTIS (US Sales Only), PC A08/MF A01.

Modified sulphur cement, available under the trade name Chement 2000, is a thermoplastic candidate material for the matrix of low, intermediate and alpha radioactive waste. The main source of sulphur is the desulphurization of fossil fuels. In view of the future increase of this product a modified compound of sulphur has been developed at the US Bureau of Mines. Modified sulphur cement as matrix material has properties in common with Portland or blast furnace cement and bitumen. The mechanical strength is comparable to hydraulic cement products. The process to incorporate waste materials is identical to bitumization. The leachability and the resistance to attack by chemicals is nearly the same as for bituminized products. This study showed also that the radiation resistance is high without radiolytic gas production and without change in dimensions (swelling). The rigidity of the matrix is a disadvantage when internal pressures are built up. The thermal conductivity and the heat of combustion of sulphur is low resulting in slow damage to the waste form under fire conditions, even when the temperature of self ignition in air is 220^{0}C. The low leachability, the very slow effective diffusion of H_2O and HTO, and the low permeability is due to the small pore diameters in the modified sulphur matrix. The loading capacity of modified sulphur cement depends on grain size and distribution and is for ungraded ashes, precipitates, dried sludges, etc., in the order of 40-50% of weight. The price of Chement 2000 per tonne is equal to those of blown bitumen.

48275 (EUR–12342) **Geochemical modelling of the Broubster natural analogue site Caithness, Scotland.** Read, D. (Epsom, (UK)); Atkins, W.S. Commission of the European Communities, Luxembourg (Luxembourg). 1989. 58p. Contract FI1W/0073-UK. Source: NTIS (US Sales Only), PC A04/MF A01.

The results of a modelling study carried out to improve understanding of speciation and actinide migration mechanisms operating at Broubster (UK) are described. This work is part of the CEC coordinated project Mirage - Second phase (Migration of radionuclides in the geosphere), research area Natural analogues.

48276 (EUR–12381) **A desk study of surface diffusion and mass transport in clay.** Cook, A.J. (British Geological Survey, Keyworth (UK)). Commission of the European Communities, Luxembourg (Luxembourg). 1989. 43p. Contact FI1W/0073-UK. Source: NTIS (US Sales Only), PC A03/MF A01.

Research into the properties of clays as barrier materials for nuclear waste disposal has led to the realization that they have important transport properties which are relatively insignificant in most other geological materials. Sorption has always been regarded as a purely retarding mechanism, but laboratory experiments over the past decade have indicated that surface diffusion of sorbed cations is a potentially significant transport mechanism in both compacted montmorillonite, and biotite gneiss. The present desk study about these issues was part of the CEC coordinated project Mirage-Second phase, research area Natural analogues.

48277 (EUR–12383) **Selection and development of an easy to process electrolyte for decontamination by electropolishing.** Steringer, A. (Kraftanlagen A.G., Heidelberg (DE)); Moser, T. Commission of the European Communities, Luxembourg (Luxembourg). 1989. 62p. (In German). Source: NTIS (US Sales Only), PC A04/MF A01.

Three different organic electrolytes: formic acid (E 1), oxalic acid (E 2) and acetylacetone (E 3) using potassium bromide (KBr) as the auxiliary electrolyte, were tested in the laboratory for electrochemically dissolving steel and stainless steel. The best results in the preliminary test series were attained with acetylacetone. It ranks among the first for current efficiency, with the produced acetylacetonates having the lowest solubility and thus they settle out of the solution in the form of coarse crystalline products. Tests were made on radioactive reactor components using acetylacetone in a 400 A test facility, to verify and optimize the decontamination factors, the electrolyte service life and the produced waste volume, as well as the respective process parameters. The surface activity of the components ranged from 2 to 10 Bq/cm^2, and a decontamination factor of 30 was attained. The obtained specific waste volume is 1.1 litre/m^2 of decontaminated surface. A gamma-spectrometric evaluation revealed that the activity in the settled-out metallic acetylacetonate is five times higher than that in the electrolyte. It is only necessary to refill the spent acetylacetonate which makes it then possible to continue to use the electrolyte solution almost unrestrictedly.

48278 (EUR–12401) **Stress analysis of HLW containers Preliminary ring test exercise Compas project.** Commission of the European Communities, Luxembourg (Luxembourg). 1989. 36p. Contract No FI1W/0111/UK. Source: NTIS (US Sales Only), PC A03/MF A01.

This document describes the series of experiments and associated calculations performed as the Compas preliminary ring test exercise. A number of mild steel rings, representative of sections through HLW containers, some notched and pre-cracked, were tested in compression right up to and beyond their ultimate load. The Compas project partners independently modelled the behaviour of these rings using their finite element codes. Four different ring types were tested, and each test was repeated three times. For three of the ring types, the three test repetitions gave identical results. The fourth ring, which was not modelled by the partners, had a 4 mm thick layer of weld metal deposited on its surface. The three tests on this ring did not give identical results and suggested that the effect of welding methods should be addressed at a later stage of the project. Fracture was not found to be a significant cause of ring failure. The results of the ring tests were compared with the partners predictions, and additionally some time was spent assessing where the use of the codes could be improved. This exercise showed that the partners codes have the ability to produce results within acceptable limits. Most codes were unable to model stable crack growth. There were indications that some codes would not be able to cope with a significantly more complex three-dimensional analysis.

48279 (EUR–12489) **Decontamination of concrete by superficial melting with a new burner associated to a plasma (feasibility study).** Pilot, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR)); Morillon, C. Commission of the European Communities, Luxembourg (Luxembourg). 1989. 58p. (In French). Contract no FI1D-0063. Source: NTIS (US Sales Only), PC A04/MF A01.

The experimental study shows that a concrete wall impregnated with Cs 137 can be decontamined. The configuration plasma + propane combustion is the more promising solution compared to plasma-air configuration : low level of NO_x (20 to 40 ppm for the first configuration, 1700 ppm for the second one) and better thermal efficiency of the jet impact. Results are analyzed and technological possibilities are evaluated.

48280 (EUR–12499) **Investigation of the potential of fuzzy sets and related approaches for treating uncertainties in radionuclide transfer predictions.** Shaw, W.; Grindrod, P. Commission of the European Communities, Luxembourg (Luxembourg). 1989. 82p. Contract No ETCC-0003. Source: NTIS (US Sales Only), PC A05/MF A01.

This document encompasses two main items. The first consists of a review of four aspects of fuzzy sets, namely, the general framework, the role of expert judgment, mathematical and computational aspects, and present applications. The second consists of the application of fuzzy-set theory to simplified problems in radionuclide migration, with comparisons between fuzzy and probabilistic approaches, treated both analytically and computationally. A new approach to fuzzy differential equations is presented, and applied to simple ordinary and partial differential equations. It is argued that such fuzzy techniques represent a viable alternative to probabilistic risk assessment, for handling systems subject to uncertainties.

48281 (EUR–12570) **Objectives, standards and criteria for radioactive waste disposal in the European Community: Euradwaste series No 1 Report of a working group on Joint elaboration of radioactive waste-management policies.** Orlowski, S. (Commission of the European Communities, Brussels (BE)); Schaller, K.H. (ed.). Commission of the European Communities, Luxembourg (Luxembourg). 1989. 89p. Source: NTIS (US Sales Only), PC A05/MF A01.

The present report, edited by a working group within the framework of the European Commission research programme on radioactive waste management and disposal, reviews the objectives, standards and criteria for radioactive waste disposal in the European Community with a view to identifying common features and differences in the regulatory frameworks of its Member States. Suggestions for possible harmonization are made. A few common general principles form the basis for legal and regulatory measures. These principles apply to and are discussed for the following: radiation protection (with the systems of dose limitation and control), ethical and sociological questions, environmental and natural resources protection, and nuclear safeguards. A description is given of the implementation of common principles, standards and requirements at Community level, in line with requirements laid down in the European Community Treaties, and in international conventions and recommendations. This is followed by a review of the implementation of basic criteria by national safety authorities. Regulatory measures and national policies, and the approaches used in devising criteria are discussed for both near-surface disposal of low-level waste, and for deep geological disposal of waste in continental geological formations. Finally, the roles and duties of the operators of radioactive waste facilities are reported. More detailed information on particular aspects is presented in the annexes.

48282 (GSF-HY–38/88, pp. 104-122) **Hydrogeological investigations at the Asse salt mine.** Batsche, H.; Rauert, W. Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Hydrologie. Oct 1989. (In German). In *Annual report 1988 of the GSF Institute of Hydrology.* Order Number DE90519861. Source: NTIS (US Sales Only), PC A12/MF A01.

On the basis of recordings of water gauge indicators for the hydrological years 1982-1987, annual hydrograph curves for the water table in borings, groundwater table hydrograph curves, natural vertical flow, as well as the times and proportionate height of ground water recharge at the Asse salt mine are established. On the basis of the hydrograph curves for tritium content in ground water, the age of the tritium model was determined. (DG).

48283 (JAERI-M–90-075) **Volume reduction of ion exchange resins by catalytic incineration, 3: Investigation of overall reaction rate.** Yahata, Taneaki (Japan Atomic Energy Research Inst., Oarai, Ibaraki (Japan). Oarai Research Establishment); Kinoshita, Koki; Hirata, Masaru. Japan Atomic Energy Research Inst., Tokyo (Japan). May 1990. 74p. (In Japanese). Order Number DE90520331. Source: NTIS (US Sales Only), PC A04/MF A01.

For development of fluidized bed incineration system armed with copper monoxide catalyst, minimum fluidization velocities at room temperature and high temperatures were examined. By comparing these data with calculated values, it was found that Wen-Yu's equation was applicable. Also by operating in various temperatures and gas velocities, most preferable condition for incinerating ion exchange resins by fluidized bed combustion was found to be temperature of 650degC, bed velocity of more than $4.91 \times 10^{-2} m \cdot s^{-1}$, and free board velocity of less than $3.36 \times 10^{-2} m \cdot s^{-1}$. Moreover by using apparent reaction rate constants obtained in this experiment, the overall reaction rate of scale-up apparatus may be predictable. (author).

48284 (LA–11671-MS) **Yucca Mountain Project far-field sorption studies and data needs.** Meijer, A. Los Alamos National Lab., NM (USA). Sep 1990. 37p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-7405-ENG-36. Order Number DE90018028. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Batch sorption experiments in which radionuclides dissolved in groundwaters from Yucca Mountain were sorbed onto samples of crushed tuff have resulted in a substantial database of sorption coefficients for radionuclides of interest to the repository program. Although this database has been useful in preliminary evaluations of Yucca Mountain as a potential site for a nuclear waste repository, the database has limitations that must be addressed before it can be used for performance assessment calculations in support of a license application for a waste repository. The purpose of this paper is to: review the applicability of simple (constant) sorption coefficients in transport calculations; review and evaluate alternative methods for the derivation of sorption coefficients; summarize and evaluate the present YMP sorption database to identify areas of data sufficiency and significant data gaps; summarize our current understanding of pertinent sorption mechanisms and associated kinetic parameters; evaluate the significance to the YMP of potential problems in the experimental determination and field

application of sorption coefficients as enumerated by the NRC (Nuclear Regulatory Commission, 1987) in its technical position paper on sorption; formulate and evaluate strategies for the resolution of NRC concerns regarding experimental problems; and formulate a position on the sorption coefficient database and the level of understanding of sorption mechanisms likely to be required in the licensing application. 75 refs., 1 fig., 2 tabs.

48285 (MIC–90-03516/XAB) **Reactor operating waste-disposal program: 1989 progress report.** Dayal, R.; Johnston, H.; Zhou, Z. Ontario Hydro, Toronto, ON (Canada). Research Div. ©1989. 76p. Source: NTIS, PC EE07/MF E01.

Summary of the progress made to date in the reactor operating waste disposal program, which focuses on both the near- and far-field investigations relevant to the long-term isolation of C-14. Near-field investigations involve evaluation of the source term for C-14 and the effectiveness of cement-based backfill materials for radiocarbon attenuation, while far-field investigations focus on the behavior and transport of C-14 in natural geologic materials. Work is also progressing on evaluation of concrete materials for high integrity containers for the storage/disposal of reactor operating waste. Evaluation of existing geochemical data, derived from low-level waste disposal sites in the U.S., is being conducted to establish the geochemical conditions and processes related to radionuclide mobility at these sites.

48286 (MIC–90-03534/XAB) **Assessment of the iron-based, stressed-shell container.** Teper, B.; Reid, S.A. Ontario Hydro, Toronto, ON (Canada). Research Div. ©1989. 125p. Source: NTIS, PC EE12/MF E01.

An iron-based, stressed-shell container is proposed for the immobilization and disposal of used CANDU fuel bundles in an up-to-1000-m deep underground vault. The container is designed to hold 72 used fuel bundles and includes a 19-tube basket, a steel cask that provides the required structural strength and a thin titanium shell placed over the steel cask for corrosion protection. An alternative design is proposed having a thick steel shell that includes a corrosion allowance. A press-fit, self-locking closure is being developed to facilitate easy and reliable remote assembly. Performance of the design was assessed through finite element analysis of stresses, buckling deformations and the long term creep. The analysis was supported by test programs on closure strength, sealing capability and creep in steel at up to 150C.

48287 (PNL-SA–17566) **Predicted drainage at a semiarid site: Sensitivity to hydraulic property description and vapor flow.** Fayer, M.J.; Gee, G.W. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 22p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-8910346–2: Conference on indirect methods for estimating hydraulic properties, Riverside, CA (USA), 11-13 Oct 1989). Order Number DE90017187. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

At the US Department of Energy's Hanford Site in southcentral Washington State, the sensitivity of predicted drainage to soil hydraulic property description and vapor flow was tested. Ten representations of the hydraulic properties were obtained by selectively using the available retention data and varying the conductivity model. The retention data for each case were fit with the Brooks-Corey retention function, and hydraulic conductivity was generated with either the Burdine or Mualem conductivity models. The resultant functions were used to simulate the 1986 water balance of a nonvegetated lysimeter containing sand, using simulations of the 1985 water balance to establish initial conditions for each case. 13 refs., 8 figs., 2 tabs.

48288 (SAND–90-1031C) **Preliminary model of repository chemistry for the Waste Isolation Pilot Plant.** Brush, L.H. (Sandia National Labs., Albuquerque, NM (USA)); Gbric-Galic, D.; Reed, D.T.; Tong, X.; Vreeland, R.H.; Westerman, R.E. Sandia National Labs., Albuquerque, NM (USA). [1990]. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901105–5: Fall meeting of the Materials Research Society, Boston, MA (USA), 26 Nov - 1 dec 1990). Order Number DE90016219. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The design-basis, defense-related, transuranic (TRU) waste to be emplaced in the Waste Isolation Pilot Plant (WIPP) could, if sufficient H_2O and nutrients were present, produce as much as 1,500 moles of gas per drum of waste. Gas production could pressurize the repository to 150 atm (lithostatic pressure) and perhaps higher. Anoxic corrosion of Fe and Fe-base alloys and microbial degradation of cellulosics are the processes of greatest concern, but radiolysis of brine could also be important. The proposed backfill additives $CaCO_3$, CaO, $CuSO_4$, KOH, and NaOH may remove or prevent the production of some of the expected gases. Because of the heterogeneous nature of design-basis waste, the Eh and pH of any brine present in WIPP disposal rooms could vary significantly over short distances after reacting with the waste. The WIPP Project is investigating the consequences of gas production and considering engineered alternatives, including reprocessing the waste, to reduce gas production rates or potentials. Reprocessing would also reduce the range of Eh and pH expected for the repository. 12 refs.

48289 (SIEMENS-KWU-E–141/89/244) **Retention capacity of rock salt. Final report.** Beyer, H.; Beck, R.; Haas, E.W. Siemens AG Unternehmensbereich KWU, Erlangen (Germany, F.R.). Bereich Energieerzeugung; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). 1989. 69p. (In German). Contract BMFT 02U5836. Source: Copy held by UB/TIB Hannover.

In laboratory column experiments the capability of loose and of pressed rock salt for retaining radioactive gases was investigated. The experiments were performed at temperatures of 48deg C and 200deg C with regard to the conditions in a repository for heat and non-heat producing radioactive waste. The investigated gases were CH_4, CO, CO_2 all C-14, HT, HTO, I_2-131, CH_3I-131, Kr-85 and Rn-222. An interaction with the rock salt was found only with two gases. HTO passed the column with a time delay depending upon the grain size of the rocksalt. A part of the injected iodine was retained on the rock salt and the other part passed the column without any delay just as the other gases. The amount of iodine retained on the salt was a function of the iodine concentration injected into the gas flow. At low concentrations more iodine was retained than at high concentrations. The isotopic exchange in the system HTO/H_2S was also investigated. It could be confirmed that there is no influence on the retardation of HTO. (orig.) With 5 figs., 16 tabs., 8 refs.

48290 (SKN–35) **Views on the calculation of flow and dispersion processes in fractured rock.** Joensson, Lennart (Lund Univ. (Sweden)). National Board for Spent Nuclear Fuel, Stockholm (Sweden). Mar 1990. 66p. Order Number DE90640174. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

Some basic aspects on model types, physical processes, determination of parameters are discussed in relation to a description of flow and dispersion processes in fractured rocks. As model types it is shown that Darcy's law and the dispersion equation are not especially applicable. These equations only describe an average situation of flow and spreading while in reality very large deviations could exist between an average situation and the flow and concentration distribution for a certain fracture geometry. The reason for this is primarily the relation between the length scales for the repository and the near field and the fracture system respectively and the poor connectivity between fractures or expressed in another way - the geosphere can not be treated as a continuous medium. The statistical properties of the fractures and the fracture geometry cause large uncertainties in at least two respects: boundary conditions as to groundwater flow at the repository and thus the mass flow of radioactive material, and distribution of flows and concentrations in planes in the geosphere on different distances from the repository. A realistic evaluation of transport and spreading of radioactive material by the groundwater in the geosphere thus requires that the possible variation or uncertainty of the water conducting characteristics of the fracture system is considered. A possible approach is then to describe flow in the geosphere on the basic of the flow in single fractures which are hydraulically connected to each other so that a flow in a fracture system is obtained. The discussion on physical processes which might influence the flow description in single fractures is concentrated to three aspects: factors driving the flow besides the

ordinary hydraulic gradient, the viscous properties of water in a very small space (such as a fracture), the influence on the flow of heat release from the repository. (42 figs., 28 refs.)

48291 (UCRL-JC–104547) **MRS role in reducing technical uncertainties in geological disposal.** Ramspott, L.D. Lawrence Livermore National Lab., CA (USA). Jun 1990. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-901101–28: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE90016861. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A high-level nuclear waste repository has inherent technical uncertainty due to its first-of-a-kind nature and the unprecedented time over which it must function. Three possible technical modifications to the currently planned US high-level nuclear waste system are reviewed in this paper. These modifications would be facilitated by inclusion of a monitored retrievable storage (MRS) in the system. The modifications are (1) an underground MRS at Yucca Mountain, (2) a phased repository, and (3) a "cold" repository. These modifications are intended to enhance scientific confidence that a repository system would function satisfactorily despite technical uncertainty. 12 refs.

48292 (WHC-EP–0063-1) **Hanford Site radioactive solid waste acceptance criteria.** Stickney, R.G. Westinghouse Hanford Co., Richland, WA (USA). [1990]. 112p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. Order Number DE90017728. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Westinghouse Hanford Company manages and operates the Hanford Site 200 Area radioactive solid waste treatment, storage, and disposal facilities for the US Department of Energy-Richland Operations Office. These facilities include radioactive solid waste disposal sites and radioactive solid waste storage areas. This manual defines the criteria that must be met by waste generators for radioactive solid waste to be accepted by Westinghouse Hanford Company for storage or disposal at the 200 Area facilities. It is to be used by all waste generators preparing radioactive solid waste for storage or disposal at the Hanford Site facilities. This manual is also intended for use by Westinghouse Hanford Company solid waste technical staff involved with approval and acceptance of radioactive solid waste. The criteria in this manual represent a compilation of state and federal regulation, US Department of Energy Orders, Hanford Site requirements, and other rules, regulations, guidelines, and standards as they apply to management of radioactive solid waste. Where appropriate, these requirements are included in the manual by reference. It is the intent of this manual to provide guidance to the waste generator in meeting the applicable requirements. 11 refs.

48293 (WHC-EP–0275-Rev.2) **Liquid effluent study project plan: Environmental and waste management: Revision 2.** Westinghouse Hanford Co., Richland, WA (USA). Aug 1990. 46p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-87RL10930. Order Number DE90017533. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

During the public comment period of the Hanford Federal Facility Agreement and Consent Order (Ecology et al. 1989) (hereinafter referred to as the Agreement), several comments were received regarding the program to reduce the discharge of contaminated liquid effluent into the soil column. In response to these comments, and at the request of the Washington Department of Ecology (Ecology) and the US Environmental Protection Agency (EPA),the US Department of Energy (DOE) is undertaking the liquid effluent study project to document the history and characteristics of liquid discharges at the Hanford Site. This Liquid Effluent Study Project Plan was approved by the EPA and Ecology through a letter dated April 9, 1990. The purpose of this project is to provide a detailed characterization of Hanford Site liquid effluents, assess waste disposal sites and groundwater contamination in area wells, and evaluate the potential for contaminant migration within receiving soil sites. Chapters 2.0 through 5.0 of this project plan outline how the streams and the disposal sites will be characterized and assessed. 22 refs., 4 figs., 3 tabs.

48294 Materials of construction and corrosion history for a low-level radioactive waste incinerator. Koenig, R.A. (Los Alamos National Lab., Los Alamos, NM (US)). 10p. National Assoc. of Corrosion Engineers, Houston, TX (USA) (1989). (CONF-890437–: Corrosion '89, New Orleans, LA (USA), 17-21 Apr 1989). Technical Paper 89199.

The Los Alamos National Laboratory has been operating a production-scale incineration system since 1976. Following the completion of initial testing, the system was modified over time to accept low and high caloric value liquids and slurries. Combustion testing of difficult waste forms continues for the DOE, the Environmental Protection Agency (EPA), the Army, the Navy, and private companies. Anticipation of the wide range of feed compositions prompted a selection of system materials processing satisfactory corrosion resistance. This paper presents these design considerations, the system construction materials. Description of corrosion incidents, and planned materials tests to guide future construction.

48295 High level radioactive waste management: Volume 1. 1456p. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This book contains the proceedings of high level radioactive waste management. Volume I. Topics covered include: natural systems—plenary, Waste package performance assessment, System data development, Waste management facilities, Social impact assessment, and System storage and technology.

48296 Basaltic volcanic episodes of the Yucca Mountain region. Crowe, B.M. (Las Vegas Office, Los Alamos National Lab., NV (US)). pp. 65-73 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper summarizes the distribution and geologic characteristics of basaltic volcanism in the Yucca Mountain region during the last 10-12 Ma. Field and geochronologic data are presented. A history of the area is given.

48297 Preliminary methodology for design of stable drifts for the Yucca Mountain Project. Bauer, S.J. (Sandia National Lab., Geotechnical Design Div., Albuquerque, NM (US)); Ehgartner, B.L.; Hardy, M.P. pp. 59-64 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC04-76DP00789. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the Yucca Mountain Project which is investigating the feasibility of locating a high-level radioactive nuclear waste repository at Yucca Mountain, Nevada. The conceptual design of the repository is described. The design methodology is presented.

48298 Smoothwall blasting planned for the underground research facility at Yucca Mountain. Bullock, R.L. (Fenix and Scisson, Inc., Las Vegas, NV (USA)); McKenzie, J. pp. 38-43 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses whether or not the Exploratory Shaft Facility (ESF) at yucca Mountain, Nevada will be completely mechanically excavated, completely developed by drilling and blasting or whether both methods will be utilized on different parts of the ESF. Where drilling and blasting may be used, smoothwall blasting techniques will be used and strict controls will be placed on drill hole placement and alignment, and the correct use of limiting damage explosive, so that minimum amount of fracturing will occur beyond the perimeter of the openings. The authors discuss why this is necessary and how it is achievable.

48299 Role of underground testing to determine suitability of Yucca Mountain as a potential repository site. Kalia, H.N. (Los Alamos National Lab., Las Vegas, NV (US)). pp. 31-37 of

High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper describes the exploratory shaft based site characterization testing program for the Yucca Mountain project of the permanent disposal of high-level radioactive waste. Details of the testing program are presented. Overview of the current planning process and status of various activities is described.

48300 **Multidisciplinary hydrologic investigations at Yucca Mountain, Nevada.** Dudley, W.W. Jr. (Geological Survey, Denver, CO (USA)). pp. 1-9 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses future climatic conditions and tectonic processes that have the potential to cause significant changes of the hydrologic system in the southern Great Basin, where a nuclear-waste repository is proposed for construction above the water table at Yucca Mountain, Nevada. Geothermal anomalies in the vicinity of Yucca mountain are presented. Tectonic effects on the hydrologic system are addressed.

48301 **Rock mechanics aspects of the ESF design.** Mrugala, M. (PB-KBB, Inc., Houston, TX (USA)); Bonabian, S. pp. 44-50 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

In this paper, selected aspects of the ESF rock mechanics design are outlined with emphasis placed specific requirements imposed on the design process conducted within quality assurance-controlled environment. Discussion is devoted to general approach used in rock support design.

48302 **International safeguards relevant to geologic disposal of high-level wastes and spent fuels.** Pillay, K.K.S. (Safeguards Systems Group, Los Alamos National Lab., Los Alamos, NM (US)); Picard, R.R. pp. 199-209 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper identifies some of the international safeguards issues relevant to the various proposed scenarios for disposing of spent fuel. In the context of the U.S. program for geologic disposal of spent fuels, this paper highlights several issues that should be addressed in the near term, before the geologic repositories for spent fuels becomes a reality. Based on U.S. spent fuel discharges, and example is presented to illustrate the enormity of the problem of verifying spent fuel inventories. The geologic disposal scenario for high-level wastes originating from defense facilities produces a practicably irrecoverable waste form.

48303 **DOE perspectives on the regulatory framework of the civilian radioactive waste management program.** Stein, R. (U.S. Dept. of Energy, Washington, DC (US)). pp. 182-187 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper identifies key statutes, regulations, and orders that govern the radioactive waste management program. Current and recent regulatory activities are described in the areas of meetings, reports, quality assurance, rulemaking and other regulatory actions. Perspectives are offered on the regulatory process involving the Nuclear Regulatory Commission and the State of Nevada. A proposal is made for a collaborative interaction involving all stake holders in the program.

48304 **Mass transport in bedded salt and salt interbeds.** Hwang, Y. (Lawrence Berkeley Lab., CA (USA)); Pigford, T.H.; Chambre, P.L.; Lee, W.W.L. pp. 163-173 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC03-76SF00098. (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper describes salt which is the proposed host rock for geologic repositories of nuclear waste in several nations because it is nearly dry and probably impermeable. Although experiments and experience at potential salt sites indicate that salt may contain brine, the low porosity, creep, and permeability of salt make it still a good choice for geologic isolation. The authors summarize several mass-transfer and transport analyses of salt repositories. The mathematical details are given.

48305 **One-dimensional radionuclide transport under time-varying conditions.** Gelbard, F. (Sandia National Labs., Albuquerque, NM (USA)); Olague, N.E.; Longsine, D.E. pp. 148-152 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC04-76DP00789. (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses new analytical and numerical solutions presented for one-dimensional radionuclide transport under time-varying fluid-flow conditions including radioactive decay. The analytical solution assumes that all radionuclides have identical retardation factors, and is limited to instantaneous releases. The numerical solution does not have these limitations, but is tested against the limiting case given for the analytical solution. Reasonable agreement between the two solutions was found. Examples are given for the transport of a three-member radionuclide chain transported over distances and flow rates comparable to those reported for Yucca Mountain, the proposed disposal site for high-level nuclear waste.

48306 **Simulation on reactive chemical transport in varying thermal field with reaction-flow coupling.** Carnahan, C.L. (Lawrence Berkeley Lab., CA (USA)). pp. 143-147 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC03-76SF00098. (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper describes a computer program, that simulates coupling between advective/diffusion solute transport and chemical reactions, coupling of the reactions to heat transport, and feedback from precipitation/dissolution reactions to fluid flow. A simple simulation of transport of dissolved silicic acid along a gradient of temperature shows how precipitation of quartz at low temperatures can drastically reduce advective transport of all solution components including trace contaminants.

48307 **Approach to developing a ground-motion design basis for facilities important to safety at Yucca Mountain.** King, J.L. (Science Applications International Corp., Las Vegas, NV (USA)). pp. 103-108 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses a methodology for developing a ground-motion design basis for prospective facilities at Yucca Mountain that are important to safety. The methodology utilizes a quasi-deterministic construct called the 10,000-year cumulative-slip earthquake that is designed to provide a conservative, robust, and reproducible estimate of ground motion that has a one-in-ten chance of occurring during the preclosure period. This estimate is intended to define a ground-motion level for which the seismic design would ensure minimal disruption to operations engineering analyses to ensure safe performance are included.

48308 **Simulation of radionuclide retardation at Yucca Mountain using a stochastic mineralogical/geochemical model.** Birdsell, K.H. (Los Alamos National Lab., NM (USA)); Campbell, K.; Eggert, K.G.; Travis, B.J. pp. 153-162 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international

topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper presents preliminary transport calculations for radionuclide movement at Yucca Mountain using preliminary data for retardation parameter distributions based on mineral distributions. Several different realizations of spatially distributed sorption coefficients are used to study the sensitivity of radionuclide migration to uncertainties in this retardation parameter. Transport calculations for a representation radionuclide cation, ^{135}Cs, and anion, $^{99}T_c$, are presented.

48309 Synthesis of studies for the potential of fault rupture at the proposed surface facilities, Yucca Mountain, Nevada. Gibson, J.D. (Sandia National Labs., Albuquerque, NM (USA)); Shephard, L.E.; Kerl, F.A.; Swan, F.H.; Wesling, J.R. pp. 109-116 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC04-76DP00789. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper describes the proposed site of the surface facilities of a high-level nuclear waste repository at Yucca Mountain. Regional faults are examined and the slip rate estimates are presented.

48310 Natural radionuclides in groundwater from J-13 well at the Nevada test site. Laul, J.C. (Pacific Northwest Lab., Richland, WA (USA)); Maiti, T.C. pp. 137-142 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC06-76RL01830. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the concentrations of U-238 and Th-232 chain members which are extremely low in J-13 water, suggesting that their concentrations in groundwaters are largely governed by sorption/desorption processes. Relative to radon (gas), uranium, thorium, radium, and polonium radionuclides are highly sorbed in a tufaceous matrix, and the retardation factors range from 10^2 to 10^5. Uranium, unlike Th, is in the + 6 state and is soluble as carbonate complex (UO_2CO_3), and the aquifer's environment is oxidizing. There is no colloidal effect down to <0.10 μm.

48311 Public communication and participation activities in siting controversial facilities in the United States and Western Europe: An examination of lessons learned. King, G.P. (USDOE Office of Civilian Radioactive Waste Management, Washington, DC (USA)); Kornfeld, K.; McAvey, V.; Munro, J. pp. 244-250 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper reviews literature discussing the siting of controversial facilities in the United States and Western Europe in order to identify lessons regarding the role of public communication and participation. Sources found that effective public communication and participation are extremely important to successful facility siting, although they do not guarantee it. Lessons fell into four categories: recognizing and addressing public concern; meeting the communication and participation needs of key publics; creating an effective siting process; and recognizing the limitations of public communication and participation. The authors discusses specific lessons, with examples from the literature, in each category.

48312 On-site representation and oversight: A special role for the state of the Nevada and Nye County in the civilian radioactive waste management program. Madore, C.M. (Weston Technical Support Team, ICF Kaiser Engineers, Washington, DC (US)); Probst, W.C. pp. 256-259 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the on-site representation and oversight provision of the Nuclear Waste Policy Act of 1982 (NWPA), as amended, which represents a continuation of a longstanding trend towards state and local government involvement in the administration of federal programs. It provides affected parties with an opportunity to safeguard the integrity of efforts to determine if Yucca Mountain, Nevada is a suitable site for the Nation's first high-level radioactive waste repository.

48313 Managing local socioeconomic impacts through project management policies concerning subsidized transportation, site access, and on-site housing. Jones, G.K. (Weston Technical Support Team, ICF Kaiser Engineers, Washington, DC (US)); Sharma, R. pp. 260-264 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses a legislative mandate to avoid, minimize and mitigate any adverse impacts to local communities resulting from activities at the Yucca Mountain Repository Project. The implementation of specific management policy decisions is addressed. The authors suggest that proactive management of socioeconomic impacts should be performed in consultation with State and local governments to identify those areas willing and able to accommodate the growth, and to provide a basis for addressing institutional issues which may arise.

48314 Diffusion barrier transport properties of unsaturated paintbrush tuff rubble backfill. Conca, J.L. (Pacific Northwest Lab., Richland, WA (USA)). pp. 394-401 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC06-76RL01830. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses diffusion coefficients experimentally determined in unsaturated tuff gravel to evaluate the effectiveness of tuff gravel and rubble as a diffusion barrier to ionic transport in the vadose zone. Gravel surface volumetric water contents and the *D* values are described. Humidity chamber experiments with both initially wet and initially dry tuff gravel are presented.

48315 Mass-transfer anaylsis of waste packages containing defense waste processing facility glass as a waste form. Apted, M.J. (Pacific Northwest Lab., Richland, WA (USA)); Engel, D.W. pp. 388-393 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the fractional release rates of selected radionuclides from waste packages containing defense waste processing facility (DWPF) glass calculated using the AREST code, assuming a continuous-diffusive pathway under partially saturated conditions. Two boundary conditions for the concentration of radionuclides at the waste-glass surface are examined. The major factors affecting the magnitude of predicted releases are described. The significant uncertainties regarding the appropriate values for these parameters are discussed.

48316 Status of integrated performance assessment of the waste packages and engineering barrier system. O'Connell, W.J. (Lawrence Livermore National Lab., CA (USA)). pp. 380-387 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract W-7405-ENG-48. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the performance assessment models specific to the proposed Yucca Mountain, Nevada site. Early assessments used for project planning and feedback are described. Advances made in sampling methods are referenced.

48317 Preclosure safety analysis for a prospective Yucca Mountain conceptual design repository. Ma, C.W. (Bechtel National, Inc., San Francisco, CA (USA)); Jardine, L.J. pp. 370-379 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract

W-7405-ENG-48. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper describes a preliminary probabilistic risk assessment performed for the prospective Yucca Mountain conceptual design repository. A new methodology to quantify radioactive source terms is discussed. A flow-on analysis for seismic events of various severity is presented.

48318 A proposed methodology for validating performance assessment models for the DOE Office of Civilian Radioactive Waste Management Program. Voss, C.F. (Pacific Northwest Lab., Richland, WA (USA)). pp. 359-363 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC06-76RL01830. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses a draft methodology for validating performance assessment models used in the licensing of high-level waste repository systems. The objective of the methodology is described and presented. Demonstration of model validity is reported.

48319 MIIT; International in-situ testing of simulated HLW forms: Preliminary analysis of SRL 165/TDS waste glass and metal systems. Wicks, G.G. (Savannah River Lab., Aiken, SC (USA)); Macedo, P.B.; Molecke, M.A.; Lodding, A.R.; Clark, D.E. pp. 443-450 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the materials interface interactions tests (MIIT) which comprise the largest cooperative field-testing venture in the international waste management community.

48320 Evaluation of near-field thermal environment conditions for a spent fuel repository in tuff. Altenhofen, M.K. (Pacific Northwest Lab., Richland, WA (USA)); Eslinger, P.W. pp. 402-409 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC06-76RL01830. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses an evaluation of near-field host rock and waste package surface temperatures for a spent fuel repository system located in a tuff geologic medium. A spent fuel logistics model of the waste management system is examined. Resulting temporal and spatial distributions are presented.

48321 A waste package strategy for regulatory compliance. Stahl, D. (Science Applications International Corp., Las Vegas, NV (USA)); Cloninger, M.O. pp. 431-436 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper summarizes the strategy given in the Site Characterization Plan (SCP) for demonstrating compliance with the post closure performance objectives for the waste package and the Engineered Barrier System (EBS) contained in the Code of Federal Regulations. The strategy, consisting of the development of a conservative waste package design that will meet the regulatory requirements with sufficient margin for uncertainty using a multi-barrier approach that takes advantage of the unsaturated nature of the Yucca Mountain site, is discussed.

48322 Current social systems issues in the U.S. high level waste management program. Cotton, T.A. (JK Research Associates, Inc., Silver Spring, MD (US)). pp. 519-524 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

Major changes in the U.S. high level waste management program since passage of the Nuclear Waste Policy Act of 1982 (NWPA) have weakened the social consensus about waste policy that existed at that time. This paper discusses establishment of a stronger and more inclusive consensus than currently exists. Agreement about the relationship between the approach to repository development and interim storage of spent fuel, and in particular about the role of a monitored retrievable storage (MRS) facility is addressed. A basis for agreement is presented.

48323 A description and status of the Yucca Mountain Project repository sealing program. Fernandez, J.A. (Sandia National Labs., Albuquerque, NM (USA)); Hinkebein, T.E. pp. 658-660 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC04-76DP00789. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper presents a description of the Yucca Mountain repository sealing program including the sealing design options, design requirements, design constraints, and the identification of the proposed sealing materials and field tests. Design options are reported. The authors include design requirements.

48324 Simulation modeling of subsurface development. Clem, W.L. (Williams Brothers Engineering Co., Weston Technical Support Team, Washington, DC (US)); Bugg, F.; Grejda, A.; Riling, G. pp. 661-666 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the use of simulation modeling in analyzing subsurface development activities and estimating associated costs at the Yucca Mountain candidate repository site. Described are the models under development and the approach to the analysis. Preliminary results from model testing, where available, illustrate simulation modeling and estimation capabilities.

48325 Vitrification of defense high level radioactive waste at Savannah River and Hanford. Ketola, W.S. (USDOE Richland Operations Office, WA (USA)); Chacey, K. pp. 790-793 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the implementation of two major elements of the Defense High-Level Radioactive Waste Management Program at Savannah River (SR) and Hanford. The Slurry/Liquid-fed Ceramic Melter Vitrification Process is discussed. The systematic methods used to define the requirements are illustrated.

48326 DOE-EM/producers strategy for wasteform and process startup acceptance. Chacey, K. (US Dept. of Energy, Office of E.R. and W.M., Washington, DC (US)); Pope, J.M.; Plodinec, M.J.; Schaus, P.S.; Maestas, E. pp. 785-789 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper articulates the joint DOE-EM/Producers' wasteform strategy regarding the activities and their review envisioned to fulfill the Waste Acceptance Process (WAP) and obtain endorsement by the Office of Civilian Radioactive Waste Management (OCRWM) and acceptance by the Nuclear Regulatory Commission (NRC) for timely plant startup.

48327 Defining the need for and functions of the monitored retrievable storage (MRS) facility. Williams, J.R. (USDOE Office of Civilian Radioactive Waste Management, Washington, DC (USA)); Cadoff, H.Y. pp. 732-738 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses a series of system studies of the Civilian Radioactive Waste Management System conducted to determine the role for a monitored retrievable waste facility (MRS). Conclusions are reported and recommendations are suggested.

48328 A demonstration of the systems integration modeling system (SIMS) as a decision-support tool. Vogel, L.W. (Science Applications International Corp., McLean, VA (USA)); Lemeshewsky, W.A. pp. 747-752 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses completion of major demonstration of the systems Integration Modeling system (SIMS). That system is designed to provide an analytic tool to support decisions relating to alternative Federal Waste Management System (FWMS) configurations and operating strategies. This paper provides an overview of SIMS and describes the results of the demonstrations, termed SIMS 89/1.

48329 High level radioactive waste management at the Savannah River Site. McIntosh, D.L. (Savannah River Lab., Aiken, SC (USA)); Papouchada, L.M. pp. 794-801 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC09-89SR18035. (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper describes the high level radioactive waste (HLW) generated at the Savannah River site (SRS). The authors outline how it has been managed over the 35 years since site operations began. Plans for future operations, with emphasis on the defense waste processing facility (DWPF) scheduled to commence operations in 1992 are discussed.

48330 The application of vertical seismic profiling and cross-hole tomographic imaging for fracture characterization at Yucca Mountain. Majer, E.L. (California Univ., Berkeley, CA (USA). Dept. of Materials Science and Mineral Engineering); Peterson, J.E.; McEvilly, T.V.; Tura, M.A. pp. 897-907 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the methods being developed, the strategy being pursued, and the rational for using VSP and crosshole methods at Yucca Mountain. The approach is intended to be an integrated method involving improvements in data acquisition, processing, and interpretation as well as improvements in the fundamental understanding of seismic wave propagation in fractured rock. The authors report that the scales of application range from a few meters to over a kilometer.

48331 Application of geophysical methods for fracture characterization. Lee, K.H. (Lawrence Berkeley Lab., CA (USA). Earth Sciences Div.); Majer, E.L.; McEvilly, T.V.; Morrison, H.F. pp. 890-896 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC03-76SF00098. (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses one of the most crucial needs in the design and implementation of an underground waste isolation facility which is a reliable method for the detection and characterization of fractures in zones away from boreholes or subsurface workings. Geophysical methods are described as a solution to this problem. The authors report that if fractures represent anomalies in the elastic properties or conductive properties of the rocks, then the seismic and electrical techniques may be useful in detecting and characterizing fracture properties.

48332 Prototype heater test of the environment around a simulated waste package. Ramirez, A.L. (Lawrence Livermore National Lab., CA (USA)); Buscheck, T.A.; Carlson, R.; Daily, W.; Latorre, V.R.; Lee, K.; Lin, W.; Mao, N.H.; Towse, D.; Ueng, T.S.; Watwood, D. pp. 870-881 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper presents selected results obtained during the 301 day duration of the prototype engineered barrier system field test (PEBSFT) performed in G-Tunnel within the Nevada Test Site. The authors discuss the evolution of hydrothermal behavior during the prototype test, including rock temperatures, changes in rock moisture content, air permeability of fractures, and gas-phase humidity in the heater borehole.

48333 Concepts in prototype testing for in situ geomechanical investigations at Yucca Mountain. Luke, B.A. (Sandia National Lab., Geotechnical Projects Div., Albuquerque, NM (US)); Finley, R.E. pp. 863-869 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC04-76DP00789. (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the geomechanical investigations that comprise a significant portion of the site characterization program to be conducted at Yucca Mountain, the site of a proposed repository for nuclear waste. The investigations include large-scale experiments conducted in an exploratory shaft facility at the site. A program of prototype testing has been initiated to ensure the success of these expensive and complex experiments. The prototype testing program addresses three problems in rock mechanics.

48334 The International Stripa project: Technology transfer from cooperation in scientific and technological research on nuclear waste disposal. Levich, R.A. (US Dept. of Energy, Yucca Mountain Project Office, Las Vegas, NV (US)); Patera, E.S.; Ferrigan, P.M.; Wilkey, P.L. pp. 848-854 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper summarizes the research conducted at Stripa and discusses the ways in which the technology developed for the Stripa Project has been and will be transferred to the United States Civilian Radioactive Waste Management Program's Yucca Mountain Project. Objectives of the project are discussed and a description of the Stripa mine is included.

48335 Prototype testing for the Yucca Mountain project. Kalia, H.N. (Los Alamos National Lab., Las Vegas, NV (US)); Girdley, W.A. pp. 843-847 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the conducting of prototype activities in welded and non-welded tuff. The authors report that these activities are in preparation for characterization of the Yucca Mountain area, which is under consideration as a site for a geologic repository in which high-level nuclear waste could be safely stored. Investigators from organizations conducting the site investigation have been afforded opportunity, through the prototype program, to test, evaluate, and develop instruments, equipment, and methods.

48336 Diffusion coefficients and hydraulic conductivity in unsaturated Hanford soils and sediments. Wright, J. (Pacific Northwest Lab., Richland, WA (USA)). pp. 835-842 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC06-76RL01830. (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper reports on measurement of two groundwater transport parameters of some Hanford formation materials, the hydraulic conductivity and the diffusion coefficient, to aid in predicting contaminant migration. The hydraulic conductivities and diffusion coefficients for five soil types were determined as functions of the water content for the aqueous phase. The author describes the degree of saturation (of the volumetric water content) in the soil.

48337 An investigation of the mechanical and hydrologic behavior of tuff fractures under saturated conditions. Voss, C.F. (Pacific Northwest Lab., Richland, WA (USA)); Shotwell, L.R.

pp. 825-834 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC06-76RL01830. (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the investigation of the mechanical and hydrologic behavior of natural fractures in a partially welded tuff rock. Tuff cores, each containing part of the same natural fracture oriented subparallel to the core axis, have been subjected to a range of stress and hydraulic gradients while simultaneously monitoring changes in the fracture aperture and volumetric flow rate. The authors report that the fractures were tested in three configurations: intact, mated, and offset.

48338 Combined analytical/numerical approaches to solving fluid flow problems in the unsaturated zone at Yucca Mountain. Zimmerman, R.W. (Lawrence Berkeley Lab., CA (USA). Earth Sciences Div.); Bodvarsson, G.S. pp. 818-824 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper presents various analytical and numerical approaches for the study of unsaturated flow processes in the vicinity of the Yucca Mountain, Nevada, the proposed site of an underground radioactive waste repository. Approximate analytical methods are used to study absorption of water from a saturated fracture into the adjacent rock. These solutions are incorporated into a numerical simulator as fracture/matrix interaction terms to treat problems such as flow along a fracture with transverse leakage into the matrix. An automatic fracture/matrix mesh generator is described; it allows for more efficient mesh generation for fractured/porous media, and consequently leads to large savings in computational time and cost.

48339 Building of a conceptual model at the UE25-c hole complex. Karasaki, K. (Lawrence Berkeley Lab., CA (USA). Earth Sciences Div.); Landsfeld, M.; Grossenbacher, K. pp. 811-817 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC03-76SF00098. (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses construction of a conceptual model of the UE25-c hole complex. An interdisciplinary approach is discussed where all the available data are integrated. Site geology, borehole geophysics and hydraulic test results at UE25-c hole complex suggest that groundwater flow may be controlled by fractures and faults. A model is proposed.

48340 An overview of the vitrification of defense high-level waste at the Hanford site. Smith, R.A. (Westinghouse Hanford Co., Richland, WA (USA)); Nyman, D.H.; Wolfe, B.A.; Bromm, R.D. pp. 806-810 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses development of a vitrification plant to process high-level waste. Storage and shipment are described and contractors involved in the project are reported.

48341 Two citizen task forces and the challenge of the evolving nuclear waste siting process. Peelle, E. (Oak Ridge National Lab., TN (USA). Energy Div.). pp. 952-960 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper compares and contrasts the siting and public participation processes as two citizen task forces dealt with their difficult responsibilities. The needs of citizen decision makers are discussed. Key differences found in the communities themselves as well as in the siting and public participation (PP) processes are presented.

48342 Modeling of coupled heat-mass stress effects in geologic media. Kelkar, S. (Los Alamos National Lab., NM (USA)); Zyvoloski, G. pp. 915-920 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses a computer code developed to investigate the importance of coupled hydraulic-thermal-mechanical processes for the potential nuclear waste storage repository at the Yucca Mountain. The code is described. The authors present several examples of two-dimensional heat transfer and fluid flow coupled with one-dimensional solid deformation. Partial verification of the code is also presented by comparing with published semi-analytical results.

48343 Seismic characterization of fracture properties. Meyer, L.R. (Lawrence Berkeley Lab., CA (USA). Earth Sciences Div.); Pyrak-Nolte, L.J.; Hopkins, D.; Cook, N.G.W. pp. 908-914 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC03-76SF00098. (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses laboratory measurements of the mechanical stiffness, hydraulic conductivity and seismic properties of three natural fractures made as a function of applied normal stress. Seismic measurements are described. Results are shown.

48344 Hedonic price theory: Concept and applications. Metz, W.C. (Argonne National Lab., IL (USA)); Lowry, J.; Morey, M. pp. 995-999 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract W-31-109-ENG-38. (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses direct and indirect techniques being used to estimate economic consequences of proximity to existing or proposed public facilities. The hedonic price theory, an indirect technique is described. The use of the hedonic price theory and the issue of transferability to radioactive waste facilities are addressed.

48345 Spent fuel storage requirements for nuclear utilities and OCRWM. Wood, T.W. (Pacific Northwest Lab., Washington, DC (USA)). pp. 1016-1025 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC06-76RL01830. (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses disposal of spent fuel prior to the shutdown of existing reactors. Additional capacity needed for surface storage is addressed. Analyses of spent fuel logistics are presented.

48346 Spent fuel and high-level waste management in selected countries: Trends and issues. Cooley, C.R. (US Dept. of Energy, Washington, DC (US)); Schneider, K.J. pp. 1006-1015 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper contains descriptions of the major parameters and plans for management of spent nuclear fuel and high-level radioactive wastes in Belgium, Canada, France, the Federal Republic of Germany, Japan, Sweden, Switzerland, the United Kingdom, and the United States. Plans for the disposal of spent fuel and/or high-level wastes in deep geologic repositories are discussed.

48347 Multi-dimensional modeling of unsaturated flow in the vicinity of exploration shafts and fault zones at Yucca Mountain, Nevada. Rockhold, M.L. (Pacific Northwest Lab., Richland, WA (USA)); Sagar, B.; Connelly, M.P. pp. 1192-1199 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC06-76RL01830. (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses modeling studies conducted to determine the potential effects of exploratory shafts on moisture distribution in the vicinity of an exploratory shaft facility, and the potential for development of perched water table conditions near fault zones in the unsaturated zone at Yucca Mountain, Nevada. Simulations were performed and are described. Simulation result are presented.

48348 **Hydrologic characterization of faults and other potentially conductive geologic features in the unsaturated zone.** Javandel, I. (Lawrence Berkeley Lab., CA (USA). Earth Sciences Div.); Shan, C. pp. 1185-1191 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC03-76SF00098. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the capability of characterizing near-vertical faults and other potentially high conductive geologic features in the vicinity of a high-level-waste repository and its importance in site characterization of underground waste-isolation projects. The possibility of using transient air pressure data at depth (resulting from surface barometric pressure fluctuations) for characterizing these features in the unsaturated zone is investigated. Analytical solutions for calculating the pressure response of such systems are presented. Solutions are given for two types of barometric pressure fluctuations.

48349 **Computed distributions of residual shaft drilling and drift construction water in the exploratory facilities at Yucca Mountain, Nevada.** Eaton, R.R. (Fluid Mechanics and Heat Transfer Div., Sandia National Lab., Albuquerque, NM (US)); Peterson, A.C. pp. 1177-1184 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC04-76DP00789. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper contains the results of engineering analytical calculations of the potential distribution of residual construction water in the exploratory shafts and drifts and numerical calculations of the movement of the residual water and how the movement is affected by drift ventilation. Rock saturation is addressed.

48350 **Important factors in developing a nuclear waste management system.** Hunter, T.O. (Nuclear Waste Repository Technology Dept., Sandia National Lab., Albuquerque, NM (US)). pp. 1170-1172 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC04-76DP00789. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses challenges presented by the nuclear waste management system. Geologic and hydrologic processes are addressed. Technical development of the system is presented.

48351 **The technical review group: An application of the quality assurance program descriptions for defense high-level waste processing.** Chacey, K.A. (US Dept. of Energy-Headquarters, Washington, DC (US)); Duggan, G.J.; Campbell, M.H. pp. 1119-1123 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper describes the formation of a technical review group (TRG) as an early application of the quality assurance program for high-level waste processing. The objectives and functions for a TRG are summarized. Organizational structure is presented. Interfaces for the TRG are described by a flow diagram following the review process from the originator's document submittal to the final approval. Interfacing organizations and their responsibilities during the review are shown. Experience to date with TRG activities are described and QA interaction is discussed.

48352 **Soluble high-level waste decontamination and disposal at the Savannah River Site.** Walker, D.D. (Savannah River Lab., Aiken, SC (USA)); Wilhite, E.L. pp. 1110-1114 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the high-level radioactive waste that has accumulated at the Savannah River Site and is stored in large underground steel tanks. Programs to remove the soluble waste from the storage tanks, decontaminate it by removing cesium and strontium, and dispose of the resulting low-level alkaline salt solution are described. Recent modifications and the current status of the in-tank precipitation and the saltstone processes are described.

48353 **The DWPF product and its qualification program.** Plodinec, M.J. (Savannah River Lab., Aiken, SC (USA)). pp. 1124-1131 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC09-89SR18035. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses immobilization of high-level nuclear waste. Production of DWPF canistered waste forms is described. Technical specifications are addressed.

48354 **The use of performance assessments in Yucca Mountain repository waste package design activities.** Jardine, L.J. (Lawrence Livermore National Lab., CA (USA)). pp. 1284-1286 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract W-7405-ENG-48. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper presents an overview of the approach under development for postclosure performance assessments that will guide the conceptual design activities and assist in the site suitability evaluations.

48355 **Overview of the U.S. Department of Energy's PACE-90 geologic repository performance assessment exercise activity.** Alexander, D. (DOE-OCRWM, Washington, DC (US)); Gnirk, P.; Rickersten, L.; Younker, J.; Van Luik, A. pp. 1275-1283 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses an effort to integrate and focus the performance-assessment activities required to support the preparation of an environmental impact statement and a license application, including a safety analysis report, for the development of a geologic repository for the permanent disposal of high-level radioactive waste at the Yucca Mountain Site in Nevada, provided the site is determined to be suitable for such development. The plans and performance included in the effort are presented. Conclusions arrived at are offered.

48356 **Opportunities.** Carlson, J.H. (USDOE Office of Civilian Radioactive Waste Management, Washington, DC (USA)); Emanuel, A. pp. 1299-1301 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper describes the potential and flexibility afforded to the negotiator. The negotiator's activities are examined, and responsibilities are mentioned.

48357 **Preliminary conceptual design description of the proposed DOE store-only monitored retrievable storage (MRS) facility.** Hale, H.J. (USDOE Office of Civilian Radioactive Waste Management, Washington, DC (USA)); Richardson, J.A. pp. 1398-1405 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the construction of a facility to accommodate civilian spent fuel and high-level waste, permit continuous

monitoring, management, and maintenance of these wastes, provide for the ready retrieval of these wastes for further processing or disposal; and safely store such wastes as long as may be necessary. A preliminary need and feasibility analysis is reviewed and conditions to be met are presented.

48358 The coordination of system representation and operating assumptions for system studies in SIMS. McKee, R.W. (Pacific Northwest Lab., Richland, WA (USA)); Short, S.M. pp. 1374-1380 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC06-76RL01830. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the development of the capability to provide descriptive details of the Federal Waste management System (FWMS) and its operating rules for comprehensive system studies. This capability design is presented. A system modeling exercise is described.

48359 Linkage between site characterization program and performance and design data needs. Blanchard, M.B. (US Dept. of Energy, Las Vegas, NV (US)); Dobson, D.C.; Younker, J.L.; Voegele, M.D. pp. 1334-1336 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses a review and evaluation of the regulatory requirements for a geologic repository. The U.S. Nuclear Regulatory Commission's (NRC) regulation governing disposal of high-level waste in a geologic repository is examined. Identification of the natural features of the site and the components of the engineered barriers considered most likely to make significant contributions to isolation of waste at Yucca Mountain is presented.

48360 Assuring data quality for use in waste management system trade-offs studies. Shay, M.R. (Pacific Northwest Lab., Richland, WA (USA)); Stiles, D.L. pp. 1325-1327 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC06-76RL01830. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper details the systems engineering approach developed to ensure the integrity of a large data library throughout its development and application. The authors assess the benefits of applying this approach to studies in which decisions must be made using results of analyses based upon this data library. They warn of potential difficulties associated with establishing such a systematic approach, and provide strategies for implementation.

48361 Characteristics of potential repository wastes. Notz, K.J. (Oak Ridge National Lab., TN (USA)). pp. 1316-1324 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC05-84OR21400. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the eventual disposal in a repository of spent fuels, high-level waste, and other radioactive wastes that may require long-term isolation. The characteristics Data Base, created to systematically tabulate the technical characteristics of these materials is presented. Data availability are given.

48362 Institutional status, challenges, and plans related to the MRS program. Probst, W. (USDOE Office of Civilian Radioactive Waste Management, Washington, DC (USA)); McCallum, R.; Stevenson, L.; Baker, R. pp. 1307-1311 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper analyzes the role of institutional considerations in the Monitored Retrievable Storage (MRS) program. Issues are discussed. The challenge of MRS siting is presented.

48363 Social issues and challenges in the disposal of nuclear waste. Easterling, J.B. (USDOE Office of Civilian Radioactive Waste Management, Washington, DC (USA)); Redmond, R.J.; Turner, E. pp. 1302-1306 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses equity and the perception of fairness as issues equal in importance to technical validity in the development of high-level waste management programs. The legislation pertinent to the issue is examined. The responsibility for administering and regulating nuclear waste activities is addressed.

48364 A systems engineering cost analysis capability for use in assessing nuclear waste management system cost performance. Shay, M.R. (Pacific Northwest Lab., Richland, WA (USA)). pp. 1370-1373 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC06-76RL01830. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the system engineering cost analysis (SECA) capability developed for use in assessing the cost performance of alternative waste management system configurations. The SECA capability design is explained. Its use is presented.

48365 Systems integration operations/logistics model (SOLMOD). Vogel, L.W. (Science Applications International Corp., McLean, VA (USA)); Joy, D.S. pp. 1365-1369 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC05-84OR21400. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses SOLMOD, a discrete event simulation model written in FORTRAN 77 and operates in a VAX or PC environment. The model's capabilities are presented. Model outputs are described.

48366 Evaluating and controlling the characteristics of the nuclear waste in the FWMS using waste stream analysis model. Andress, D. (David Andress and Associates, Inc., Kensington, MD (US)); Joy, D.S.; McLeod, N.B. pp. 1357-1364 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the waste stream analysis (WSA) model used by the Department of Energy to model the time and location dependent properties of the nuclear waste stream in the Federal Waste Managements System and at utility spent fuel storage facilities. It's abilities are described.

48367 The systems integration modeling system. Danker, W.J. (USDOE Office of Civilian Radioactive Waste Management, Washington, DC (USA)); Williams, J.R. pp. 1351-1356 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the systems integration modeling system (SIMS), an analysis tool for the detailed evaluation of the structure and related performance of the Federal Waste Management System (FWMS) and its interface with waste generators. It's use for evaluations in support of system-level decisions as to FWMS configurations, the allocation, sizing, balancing and integration of functions among elements, and the establishment of system-preferred waste selection and sequencing methods and other operating strategies is presented. SIMS includes major analysis submodels which quantify the detailed characteristics of individual waste items, loaded casks and waste packages, simulate the detailed logistics of handling and processing discrete waste items and packages, and perform detailed cost evaluations.

48368 Data quality assurance controls through the WIPP in situ data acquisition, analysis and management system. Munson, D.E. (Sandia National Labs., Albuquerque, NM (USA)); Ball, J.R.; Jones, R.L. pp. 1337-1350 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC04-76DP00789. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses that tests supply the information for development and verification of the technology required for construction of a radioactive waste repository in bedded salt. A major project task undertaken for the acquisition, control, and preservation of all the associated in situ test databases, with the principal emphasis on the very large thermal/structural in situ tests is presented. The WIPP In Situ Data Acquisition, Analysis, and Management (WISDAAM) System was put into place is examined.

48369 Fabrication and closure development of nuclear waste containers for storage at the Yucca Mountain, Nevada repository. Russell, E.W. (Lawrence Livermore National Lab., CA (USA)); Nelson, T.A.; Stein, K.O.; Domian, H.A.; La Count, D.F.; Robitz, E.S. pp. 1406-1413 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract W-7405-ENG-48. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the determination that the Yucca Mountain site in Nevada is to be characterized to determine its suitability for construction of the first U.S. high-level nuclear waste repository. Work in connection with this site is examined. Various fabrication and closure methods are under consideration for the production of containers. This paper presents progress in identifying and evaluating the candidate manufacturing processes.

48370 The expected condition of spent LWR fuel on delivery to a repository. Bailey, W.J. (Pacific Northwest Lab., Richland, WA (USA)); Johnson, A.B. Jr. pp. 1437-1443 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the condition of spent fuel on delivery to a repository which is affected by its service in the reactor and by the postirradiation activities including wet and dry storage: Fuel examination, fuel reconstitution, and rod consolidation; and handling and transporting are examined. Current assessments are reported. Potential impacts of fuel with cladding breaches exposed to oxidizing atmospheres and effects of crude loosened by extended wet storage are anticipated.

48371 High-level radwaste plans in nine countries. Cooley, C.R. (U.S. Dept. of Energy, Washington, DC (US)); Chan, C.Y.; Schneider, K.J. *Chemical Engineering Progress (USA)*, 86(7): 68-74 (Jul 1990).

When, where, and how should nations dispose of their spent nuclear fuel and high-level waste? Can deep geological disposal be shown to be inherently safe for thousands of years? Such worldwide issues have made radioactive waste management one of the most important issues for nuclear power today. Based on a growing scientific consensus, international organizations and most countries with nuclear power have expressed confidence that deep geological disposal is the preferred method for the long-term disposal of spent nuclear fuel (SF) and high-level waste (HLW). As a result, several countries are now developing and implementing waste-management strategies based on geological disposal. The strategies and technical programs for radioactive waste management in Belgium, Canada, France, the Federal Republic of Germany, Japan, Sweden, Switzerland, the United Kingdom, and the United States are described briefly as examples of the progress and plans for SF and HLW management.

0530 Environmental Aspects

Refer also to citation(s) 48228, 48259, 48262, 48281, 48293, 48305, 48306, 48308, 48310, 48315, 48344, 48353, 48380, 48384, 48386, 48618, 49175, 49176, 49572, 49596, 49597

48372 (ANSTO/E–688) **Environmental survey at Lucas Heights Research Laboratories, 1987.** Giles, M.S.; Foy, J.J.; Hoffmann, E.L. Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia). Dec 1989. 29p. Order Number DE91601974. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Results are presented of an environmental survey conducted in the neighbourhood of the Lucas Heights Research Laboratories during 1987. No radioactivity which could have originated from these laboratories was found in samples collected from possible human food chains. All low-level liquid and gaseous waste discharges were within authorized limits. The maximum possible annual dose to the general public from airborne waste during this period is estimated to be less than 0.01 millisieverts, which is one per cent of the limit for long-term exposure that is recommended by the National Health and Medical Research Council. 9 refs., 18 tabs., 2 figs.

48373 (UCRL-ID–104196) **An investigation of the critical facility tritium monitoring.** Merrill, R.D. Lawrence Livermore National Lab., CA (USA). 14 May 1990. 18p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90016676. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The critical facility tritium monitoring system was investigated to determine its current configuration; analyze its operational reliability, maintainability, and upgradeability; and recommend possible actions which might be taken to improve its operation. The principal intent of the system is to keep a constant vigil of possible accidental tritium releases, and alert all personnel and the fire department should any be detected. The emphasis is on long term reliability and a clear precise presentation of the tritium release situation, should one occur. It was found that the system consisting of 21 room, 20 hood, and 4 stack monitors linked to hood, room and building annunciators is functioning adequately, however, the maintenance staff is stretched to their limit, and any alterations or additions to improve functionality or ease the maintenance load would be impractical. Two alternative approaches are presented which would correct these conditions to varying degrees. The first approach would replace all monitor cabling and central annunciator equipment with a modern computer-based, networked subsystem; and the second approach would extend this upgrade to include replacing the monitors themselves as well. 3 figs.

48374 Deposition of airborne particles from fractured spent fuel or high-level waste. Ma, C.W. (Bechtel National, Inc., San Francisco, CA (USA)); Zavorshy, S.J.; Jardine, L.J. pp. 713-722 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC04-76DP00789. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the preliminary equations developed to predict the amount of deposition of airborne particles that may result from an accidental release in a hot cell. The fraction of these airborne particles that may be released to the atmosphere is also calculated without taking credit for the filtration effect of the hot cell filters. Other equations and models are developed to determine the depletion of airborne particles from the airstream due to dry deposition outside the building. The results indicate that for postulated accidents involving severe mechanical impacts of spent fuel assemblies and high-level waste canisters, depositions may significantly reduce the offsite doses.

0540 Health and Safety

Refer also to citation(s) 48231, 48232, 48234, 48258, 48262, 48267, 48372, 49164, 49175, 49176

48375 (CEA-DAS-STAS-SPI–1) **Bibliographic study specifying the limits of fire risk presented by uranium dioxide**

powder. Vasseur, C.; Ponsart, D.; Savornin, J. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete. Sep 1988. 17p. (In French). Order Number DE91700310. Source: NTIS (US Sales Only), PC A03/MF A01.

This study discusses papers on oxidation of uranium dioxide and fire risks and in particular the report by J. Florestan. In conclusion there is no particular fire hazards for usual quality of uranium dioxide. Nevertheless for high specific surface area powders over 8 sq m/g risks are not excluded.

48376 **Ventilation design for the Exploratory Shaft Facility Yucca Mountain Project.** Jurani, R.S. (Fenix and Scisson, Inc., Las Vegas, NV (USA)). pp. 51-58 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the main construction task for high-level nuclear waste disposal in a geologic repository. The activity involved is described. The author discusses how ventilation design requirements are established and satisfied based upon current criteria.

48377 **Public involvement: Keystone to public confidence in the civilian radioactive waste management program.** Meier, D. (Weston Technical Support Team, ICF Kaiser Engineers, Washington, DC (US)); Niedzielski-Eichner, P.A.; Probst, W.C. pp. 220-225 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the barriers to public confidence in the safety of high level radioactive waste facilities and how they can be overcome. Public involvement is explored and the implications of various approaches are presented.

48378 **Initiating event identification and screening for nuclear waste repository preclosure risk assessment.** Harris, P.A. (HLB Advanced Technology, Del Mar, CA (US)); Bolig, C.A.; Brown, T.D. pp. 364-369 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC04-76DP00789. (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper describes a method to identify potential initiating events that might occur during the preclosure phase at a nuclear waste repository proposed for the Yucca Mountain area of Nevada. Initiating events of interest are described. Results are explained.

48379 **^{14}C release failed spent fuel containers.** Pescatore, C. (Brookhaven National Lab., Upton, NY (USA)). pp. 426-430 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses partially failed containers that may provide a meaningful barrier to the release of gaseous radionuclides. A modeling approach is outlined and sample calculations are provided that show the effects on release due to a limited perforation area, to decreasing temperature, and to the partial occlusion of the perforated area by corrosion products.

48380 **A gas-flow source term from a nuclear waste container in an unsaturated medium.** Zwahlen, E.D. (Lawrence Berkeley Lab., CA (USA)); Pigford, T.H.; Chambre, P.L.; Lee, W.W.L. pp. 418-425 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper presents some initial analyses of gas flow into and out of nuclear waste containers, through holes of specified timing and sizes. The authors predict the release rate of selected volatile species, and investigate the effect of initial temperature and pressure of the container gas. They consider the definition of container failure.

48381 **Operational considerations in specifying legal weight vehicles for the highway transport of spent nuclear fuel.** Hill, C.V. (Science Applications International Corp., Oak Ridge, TN (USA)); Rutenkroger, E.O.; Ratledge, J.E. pp. 504-511 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper presents the results of a research project in which tractor manufacturers and carrier companies were interviewed to gather information on operational concerns in specifying a tractor to haul legal weight spent fuel casks. The interaction between driver fatigue,safety, and equipment is discussed, as are innovative operating strategies that could save weight.

48382 **Investigation of burnup credit allowance in the criticality safety evaluation of spent fuel casks.** Lake, W.H. (US Dept. of Energy, Washington, DC (US)); Sanders, T.L.; Parks, C.V. pp. 777-784 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC04-76DP00789. (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses work in progress on criticality analysis verification for designs which take into account burn up and aging in the transported fuel. The work includes verification of cross section data, correlation with experiments, proper extension of the methods into regimes not covered by experiments, establishing adequate reactivity margins, and complete documentation of the project. Recommendations for safe operational procedures are included, as well as a discussion of the economic and safety benefits of such designs.

48383 **Experience with certifying borated stainless steel as a shipping cask basket material.** Abbott, D.G. (Idaho National Engineering Lab., Idaho Falls, ID (USA)); Nickell, R.E. pp. 771-776 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC07-76ID01570. (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the original cask designs for a cask demonstration project that has featured fuel baskets constructed of borated stainless steel (bss) as a structural material. The project is intended to demonstrate casks that can be used for both shipping and storing spent nuclear fuel assemblies. The baskets were intended to maintain the fuel assemblies in a subcritical array for both normal and accident conditions. The Nuclear Regulatory Commission, judged bss to be unacceptable as a structural material. The cask designs were subsequently modified. The knowledge gained during this cask demonstration project may be applicable to development of bss as a basket material in future cask design.

48384 **Risk perspective on potential releases of ^{14}C from the geologic repository at Yucca Mountain.** Quan, C. (US Dept. of Energy, Washington, DC (US)); Livnat, A.; Michlewicz, D.; Palbrica, R. pp. 706-712 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406--: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper provides a perspective on the individual and population risks from potential releases of ^{14}C from a geologic repository at the candidate Yucca Mountain site by examining the quantity and release potential of the ^{14}C available in the waste, its geohydrologic transport in the unsaturated setting of the site, and the potential radiological consequences of the releases. Dose estimates are reported. Calculations are explained.

48385 **Accident analysis in fulfillment of the requirements of the national environmental policy act and their relationship to the packaging and testing requirements of the Nuclear Regulatory Commission.** Darrough, M. (US Dept. of Energy, Forrestal Building, Washington, DC (US)); McSweeney, T.; Rothman, R. pp. 1080-1085 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990).

(CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper presents a proposed approach to assess transportation accidents in OCRWM's fulfillment of NEPA requirements. This proposed approach builds on the methodology used in the NRC assessments of transportation accidents, frequently called the Modal Study. The authors demonstrate compatibility between the two regulatory perspectives.

48386 **A literature-based preliminary characterization of risks in the nuclear waste management system.** Daling, P.M. (Pacific Northwest Lab., Richland, WA (USA)); Rhoads, R.E.; Van Luik, A.E. pp. 1328-1383 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC06-76RL01830. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper reviews the literature containing information on risks in the nuclear waste management system and uses this information to develop preliminary estimates of the potential magnitudes of these risks. Information collected on a broad range of risk categories is examined. Information about the repository, the integral Monitored Retrievable Storage (MRS) facility, and the transportation system that supports the repository and the MRS facility is included.

48387 **Method for determining the fuel contribution to the source term in transport casks.** Rashid, Y.R. (Anatech International Corp., La Jolla, CA (USA)); Lake, W.H.; Sanders, T.L. pp. 1418-1424 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC04-76DP00789. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses a comprehensive source term characterization methodology developed for the determination of the fuel contribution to the potentially releasable radioactivity in spent fuel shipping casks. Detailed models and analytical procedures are applied. Methodology adopting a combined deterministic/probabilistic analysis approach in which each aspect of the problem is appropriately treated on the basis of its level of determinability is presented.

0550 Safeguards, Inspection, and Accountability

Refer also to citation(s) 48302, 48851

48388 (CONF-9007106–72) **Reprocessing input data validation.** Persiani, P.J.; Bucher, R.G.; Pond, R.B.; Cornella, R.J. Argonne National Lab., Idaho Falls, ID (USA). [1990]. 8p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From Institute of nuclear materials management conference; Los Angeles, CA (USA); 15-18 Jul 1990. Order Number DE90017686. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Isotope Correlation Technique (ICT), in conjunction with the gravimetric (Pu/U ratio) method for mass determination, provides an independent verification of the input accountancy at the dissolver or accountancy stage of the reprocessing plant. The Isotope Correlation Technique has been applied to many classes of domestic and international reactor systems (light-water, heavy-water, graphite, and liquid-metal) operating in a variety of modes (power, research, production, and breeder), and for a variety of reprocessing fuel cycle management strategies. Analysis of reprocessing operations data based on isotopic correlations derived for assemblies in a PWR environment and fuel management scheme, yielded differences between the measurement-derived and ICT-derived plutonium mass determinations of $(-0.02 \pm 0.23)\%$ for the measured U-235 and $(+0.50 \pm 0.31)\%$ for the measured Pu-239, for a core campaign. The ICT analyses has been implemented for the plutonium isotopics in a depleted uranium assembly in a heavy-water, enriched uranium system and for the uranium isotopes in the fuel assemblies in light-water, highly-enriched systems. 7 refs., 5 figs., 4 tabs.

48389 (IAEA-INFCIRC–278(Corr.1)) **The text of the Agreement of 12 July 1973 between Costa Rica and the Agency for the application of safeguards in connection with the Treaty for the Prohibition of Nuclear Weapons in Latin America and the Treaty on the Non-Proliferation of Nuclear Weapons.** International Atomic Energy Agency, Vienna (Austria). Mar 1990. 2p. Order Number DE91602673. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The document contains the replaced Protocol to the Agreement contained in document INFCIRC/278 issued in order to correct the numbers of the Articles referred to in the Protocol.

48390 (IAEA-INFCIRC–376) **Agreement of 2 October 1989 between the Socialist Republic of Viet Nam and the International Atomic Energy Agency for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons.** International Atomic Energy Agency, Vienna (Austria). Mar 1990. 34p. Order Number DE91602674. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The document contains two parts. The first part stipulates the agreement of Viet Nam to accept safeguards on all source or special fissionable material in all peaceful nuclear activities within its territory, under its jurisdiction or carried out under its control anywhere, for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices. The second part specifies the procedures to be applied in the implementation of the safeguards provisions of Part I.

48391 (IAEA-INFCIRC–381) **Agreement of 24 February 1989 between the Republic of Tunisia and the International Atomic Energy Agency for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons.** International Atomic Energy Agency, Vienna (Austria). Jul 1990. 34p. Order Number DE91602676. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Hard copies are available in English and French from IAEA Division of Publications, Distribution Unit.

The document contains two parts. The first part stipulates the agreement of Tunisia to accept safeguards on all source or special fissionable material in all peaceful nuclear activities within its territory, under its jurisdiction or carried out under its control anywhere, for the exclusive purpose of verifying that such material is not diverted for nuclear weapons or other nuclear explosive devices. The second part specifies the procedures to be applied in the implementation of the safeguards provisions of Part I.

48392 (JAERI-M–90-074) **Automatic remote communication system: Development of the upgraded RECOVER system.** Yamamoto, Yoichi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). May 1990. 129p. (In Japanese). Order Number DE90520222. Source: NTIS (US Sales Only), PC A07/MF A01.

The Upgraded RECOVER (Remote Continual Verification) system is a communication system for remote continual verification of security and safeguards status of nuclear material in principal nuclear facilities. The system is composed of a command center and facility sub-systems. A command center is a mini-computer system to process C/S (Containment and Surveillance) status data. Facility sub-systems consists of OSM (On-site Multiplexer), MU (Monitoring Unit) and C/S sensor. The system uses public telephone network for communication between a command center and facility subsystems, and it encrypts communication data to prevent falsification and wiretapping by unauthorized persons. This system inherits the design principle of RECOVER system that was tested by IAEA before. We upgraded and expanded its capabilities more than those of RECOVER. The development of this system began in 1983, and it finished in 1987. Performance tests of the system were carried out since 1987. It showed a farely good result with some indications which should need further improvements. The Upgraded RECOVER system provides timely information about the status of C/S systems, which could contribute to the reduction of inspection effort and the improvement of cost performance. (author).

48393 (RFP–4433) **Statistical calibration and periodic performance checks for segmented gamma scanning.** Weier, D.R.;

Jeffers, B.W. EG and G Rocky Flats, Inc., Golden, CO (USA). [1990]. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. (CONF-9007106–58: Institute of nuclear materials management conference, Los Angeles, CA (USA), 15-18 Jul 1990). Order Number DE90015672. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The use of no intercept, Poisson weighted least squares regression for the calibration and ongoing performance checks of segmented gamma scanning is discussed. The lack of fit to a straight line which can result when process materials are used as standards is considered; it is concluded as a variation source in estimating gram uncertainty, but bias corrections are made in conducting instrument performance checks. Applications to actual calibration data are given. 6 figs.

48394 (SAND–90-0494) **An infrared imaging area sensor for tactical and physical security applications.** Pritchard, D.A. Sandia National Labs., Albuquerque, NM (USA). Jul 1990. 22p. Sponsored by U.S. Department of Defense; U.S. DOE Radioactive Waste Management. DOE Contract AC04-76DP00789. Order Number DE90016689. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Thermal imagers are effective tools for detecting aggressive actions and enhancing physical security in both tactical and peacetime environments. However, from an operator's perspective, these devices are rarely used on a continuous basis because of inconvenience and a requirement to have the operator be the "detector" while using the imager as a sensor. This paper describes an area sensor and assessment system designed to reduce operator fatigue and improve the effectiveness of costly thermal imagers. Several prototypes have been installed and operated at sites worldwide. The device uses a thermal imager as the primary sensor but also incorporates a laser range-finder, automatic area precision scanning, robust scan-to-scan scene change detection, and deliberate-motion detection features. The system setup, control, and alarm assessment functions of the operator console are described. The digital processing is discussed and performance measures are given. 2 refs., 7 figs.

48395 (UCRL-JC–104361) **Validating detection probabilities for the ASSESS [Analytic System and Software for Evaluating Safeguards and Security] Insider database.** Renis, T.A.; Saleh, R.A.; Sicherman, A. Lawrence Livermore National Lab., CA (USA). 16 Jul 1990. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9007106–70: Institute of nuclear materials management conference, Los Angeles, CA (USA), 15-18 Jul 1990). Order Number DE90017524. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Evaluating protection effectiveness against potential threats requires an extensive amount of information about possible adversary actions an safeguards detection probabilities. To aid this process, the Insider module of ASSESS (Analytic System and Software for Evaluating Safeguards and Security) contains an extensive database of possible insider actions involving theft of special nuclear material, and detection probabilities for safeguards components against those actions. To enhance the credibility of evaluation results, we've designed a program for validating and testing this generic database. The Insider database has been carefully structured so that each detection probability corresponds to a well-defined event. In this paper, we describe how we use these detailed event descriptions for structuring and conducting an effective performance testing program. We discuss how to: determine the type of validation/testing procedures that are appropriate for each probability assignment; define a reasonable level of precision for the probability estimates; combine test results and expert opinions; and address the relationship between similar detection situations. These considerations provide the basis for developing a practical safeguards performance validation/testing program with minimal impact on a facility's operations and personnel. We conclude with a discussion about designing facility-specific testing programs to take advantage of the ongoing ASSESS Insider database validation and testing effort.

0560 Legislation and Regulations

Refer also to citation(s) 48281, 48292, 48303, 48312, 48355, 48356, 48362, 48363, 48371, 48590, 48591

48396 (IAEA-INFCIRC–209(Mod.2/Add.3)) **Communications received from Members regarding the export of nuclear material and of certain categories of equipment and other material: A further communication dated 8 May 1990.** International Atomic Energy Agency, Vienna (Austria). Jul 1990. 1p. Order Number DE91602644. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The document informs that the Director General received a letter dated 8 May 1990 from the Resident Representative of Luxembourg to the Agency regarding the export of nuclear material and of certain categories of equipment and other material.

48397 (IAEA-INFCIRC–209(Mod.3/Add.3)) **Communications received from Members regarding the export of nuclear material and of certain categories of equipment and other material: A further communication dated 9 May 1990.** International Atomic Energy Agency, Vienna (Austria). Jul 1990. 1p. Order Number DE91602645. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The document informs that the Director General received a letter dated 9 May 1990 from the Resident Representative of Luxembourg to the Agency regarding the export of nuclear material and of certain categories of equipment and other material.

48398 (IAEA-INFCIRC–209(Mod.4/Add.1)) **Communications received from Members regarding the export of nuclear material and of certain categories of equipment and other material: Further communications dated 1 June 1990.** International Atomic Energy Agency, Vienna (Austria). Jul 1990. 1p. Order Number DE91602646. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The document informs that the Director General has received letters dated 1 June 1990 from the Resident Representatives to the Agency of Denmark, the Federal Republic of Germany, Ireland, Luxembourg and Poland regarding the export of nuclear material and of certain categories of equipment and other material.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

48399 (MIC–90-03519/XAB) **Method of measuring Cl_3T activity developed for laser-based tritium separation.** Morrison, H.D. Ontario Hydro, Toronto, ON (Canada). Research Div. ©1989. 18p. Source: NTIS, PC EE07/MF E01.

The development of laser-based tritium separation requires experiments on the dissociation of tritiated trifluoromethane, CF3T. Analysis of the dissociation involves measures of the changes in concentration of CF3T in CF3H by measuring the specific activity of the CF3T. This report describes the instrument and the techniques applied.

48400 (MIC–90-03527/XAB) **Third isotope separation workshop.** Morrison, H.D. Ontario Hydro, Toronto, ON (Canada). Research Div. ©1989. 204p. Source: NTIS, PC EE17/MF E01.

Report of the workshop, covering background information on Ontario Hydro's interest in isotope separation, including sales and service and the tritium removal facility at Darlington; and technical papers on topics related to isotope separation of hydrogen and of zirconium using distillation, especially at cryogenic temperatures.

0702 Radiation Sources

Refer also to citation(s) 48985, 49376, 49401

48401 (BISI-EM-TRANS–196) **Crosslinking of thermoplastics by gamma-irradiation in industrial conditions.** Birkigt, W.

(VEB MLW Keradenta-Werk, Radeberg (German Democratic Republic)); Mueller, R.; Posselt, K. Institute of Metals, London (UK). [1989]. 16p. Translated from Gummi Fasern Kunststoffe 1988, v. 41(4) p. 160-164. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Translated from Gummi Fasern Kunststoffe 1988, v. 41(4) p. 160-164.

The material properties of thermoplastics can be improved by irradiation-induced crosslinking. Polyethylene crosslinked by radiation exhibits higher resistance to chemicals and low susceptibility to stress cracking, cold flow and sub-zero impact damage. Mechanical properties at elevated temperatures and heat distortion temperatures are increased. Using the shape-memory effect, it is also possible to produce heat-shrunk products from crosslinked thermoplastics. (Author).

48402 (CONF-900873–3) **Neutron beam characterization at the Neutron Radiography Reactor (NRAD).** Imel, G.R.; Urbatsch, T.; Pruett, D.P.; Ross, J.R. Argonne National Lab., Idaho Falls, ID (USA). [1990]. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From 1. international topical meeting on neutron radiography system design and characterization; Pembroke (Canada); 28-30 Aug 1990. Order Number DE90017830. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The Neutron Radiography Reactor (NRAD) is a 250-kW TRIGA Reactor operated by Argonne National Laboratory and is located near Idaho Falls, Idaho. The reactor and its facilities regarding radiography are detailed in another paper at this conference; this paper summarizes neutron flux measurements and calculations that have been performed to better understand and potentially improve the neutronics characteristics of the reactor.

48403 (CONF-901101–18) **Advanced Neutron Source: The users' perspective.** Peretz, F.J. Oak Ridge National Lab., TN (USA). [1990]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From American Nuclear Society winter meeting; Washington, DC (USA); 11-15 Nov 1990. Order Number DE90014217. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

User experiments will cover fields such as activation analysis of pollutants, irradiation of materials for the fusion program, and neutron scattering studies of materials as diverse as viruses, aerospace composites, and superconductors. Production capabilities must also be provided for the production of isotopes, especially of transuranic elements. The different ways in which these research areas and their required infrastructure influence the design of the Advanced Neutron Source will be the subject of this paper.

48404 (CONF-901101–20) **Advanced Neutron Source: The designer's perspective.** Peretz, F.J. Oak Ridge National Lab., TN (USA). [1990]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From American Nuclear Society winter meeting; Washington, DC (USA); 11-15 Nov 1990. Order Number DE90014206. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Advanced Neutron Source (ANS) is a research facility based on a 350 MW beam reactor, to be brought into service at the Oak Ridge National Laboratory at the end of the century. The primary objective is to provide high-flux neutron beams and guides, with cold, thermal, hot, and ultra-cold neutrons, for research in many fields of science. Secondary objectives include isotopes production, materials irradiation and activation analysis. The design of the ANS is strongly influenced by the historical development of research and power reactor concepts, and of the regulatory infrastructure of the Department of Energy (DOE) and the Nuclear Regulatory Commission (NRC). Current trends in reactor safety also impact the climate for the design of such a reactor.

48405 (EUR–12522, pp. 227-235) **Neutron radiography.** Barton, J.P. Commission of the European Communities, Luxembourg (Luxembourg). 1989. (CONF-8904378–: HFR Colloquium, PETTEN (Netherlands), 20-21 Apr 1989). In *Prospects and future utilization.* Order Number DE91702056. Source: NTIS (US Sales Only), PC A18/MF A01.

This introduction is addressed to an audience active in diverse forms of neutron source applications but not directly familiar with neutron radiography. Neutron radiography is, of course, similar to, and complementary to, radiography using x-rays. However, neutrons, being sensitive to the nuclear properties of materials, provide information fundamentally different from x-rays. For example, neutrons can penetrate many dense metals such as uranium, lead, bismuth or steel, and can reveal details of internal hydrogenous components: explosives, lubricants and gaskets. For nuclear fuel inspection neutron radiography offers the ability to penetrate dense uranium-238 and contrast the isotopes U-235 or Pu-239 and also offers the ability to discriminate against unwanted interference from gamma radiation. In addition to advantages in industrial applications, there are special situations in fields such as medical diagnostics, dentistry, agriculture and forensic science. Comprehensive accounts of applications in the field can be found in the proceedings of the world conferences on neutron radiography: USA (1981), FRANCE (1986). A third conference in this series is scheduled for May 1989 in Japan.

48406 (JAERI-M–89-228, pp. 19-26) **New trends in radiation processing application in Japan.** Machi, Sueo (Japan Atomic Energy Research Inst., Takasaki, Gunma (Japan). Takasaki Radiation Chemistry Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-890722–: International symposium on radiation resistance of organic material in radiation environment, Takasaki (Japan), 24-25 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

The research and development of the application of radiation processing have been carried out for more than 30 years, which resulted in the industrial application to new polymeric materials, surface reforming, the sterilization of medical products and food irradiation. Now, about 180 electron beam machines and 10 cobalt-60 facilities are used for radiation processing. The research and development have been carried out in Governmental institutes such as JAERI and private companies. The radiation processing for environment conservation has been conducted, and radiation chemistry will provide the fundamental theory for estimating the life time of organic materials used for nuclear plants under radiation. Drugs can be capsuled in polymer matrices by radiation-induced polymerization without their thermal degradation, and this gives the new process to prepare drug delivery system. The applications to battery separator, new deodorant, crosslinked cable insulator, heat shrinkable material and foamed polyethylene, and curing of surface coating are described. As for environment conservation, the removal of sulfur oxides and nitrogen oxides from stack gas, water treatment and sewage sludge treatment by irradiation have been studied. (K.I.).

48407 (ORNL/FTR–3716) **[New techniques and design approaches of neutron scattering facilities]: Foreign trip report, July 1, 1990–July 30, 1990.** Shapira, H.B. Oak Ridge National Lab., TN (USA). 6 Sep 1990. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90017559. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The lead in most aspects of neutron scattering passed from the USA to Western Europe about 15 years ago. If the Advanced Neutron Source (ANS) is to shift the lead back to the USA, it will require the world's best design and construction in several areas in which there is little or no experience in this country: from instrumentation to facility design. I visited three sites recognized as leading world laboratories for reactor-based neutron research. I was given access to all areas of the reactor, reactor support, experiment and experiment support, i.e., the facility in general. I obtained valuable information relevant to the design of the ANS facility as well as specific advice and constructive criticism for the ANS site and facility plans as a result of the discussions about the ANS facility and Site Design which I delivered at each laboratory.

0703 Isotopic Power Supplies

48408 (LA-UR–90-2164) **Galileo light-weight radioisotope heater units design and safety analysis.** Johnson, E.W. (EG and

G Mound Applied Technologies, Miamisburg, OH (USA)); Zocher, R.W. Los Alamos National Lab., NM (USA). [1990]. 7p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-7405-ENG-36 ;AC04-88DP43495. (CONF-901101–16: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE90013151. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Light-Weight Radioisotope Heater Unit (LWRHU) provides thermal energy to temperature sensitive components aboard the orbiter/probe of the Galileo Spacecraft during its multiyear interplanetary mission. Heat is derived from the radioisotopic decay of 238-plutonium. A power of 0.56 watts/gram of radioisotope, a half-life of 88 years, and no moving parts permitted a robust, long-lived, compact heat source design. A single l-w design provided small thermal increments, with options in the number and placement, to satisfy the needed thermal environment for the spacecraft components. Radioisotope use in these devices necessitated the assessment of postulated radiological risks in accidents or malfunctions of the space shuttle or the Galileo spacecraft during near earth mission phases. Included in this document are data for the design, postulated accidents with their consequences, test data, and the derived source terms and personnel exposures for the various events. 5 refs., 1 fig., 1 tab.

0705 Health and Safety

Refer also to citation(s) 48408

09 BIOMASS FUELS

0907 Resources

48409 (EUR–11382, pp. 13-26) **Bio-energy-industrial integrated regional projects in the European community.** Grassi, G. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

The high level development of our society has been possible by the exploitation of the immense stock of energy stored in the fossil biomass over millions of years and the food and non-food vegetal matter constantly produced on the earth. In the long term, biomass will assume more and more the role of a strategic, renewable, industrial energy resource.

48410 (EUR–11382, pp. 125-137) **Technical possibilities and economic conditions of producing biomass for energy.** Kocsis, K. (FAO Regional Office for Europe, Rome (Italy)). Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

Five research networks and fourteen working groups have been established within the framework of the FAO European Cooperative Networks on Rural Energy (CNRE) in order to promote the exchange of technical and scientific information and the practical application of new and renewable sources of energy (NRSE) in rural sectors of Europe and in interested developing countries. During the year 1983-87, technical consultations and workshops were organized, reports, bulletins and state-of-the-art studies were prepared and distributed to participating institutions. On the basis of papers presented and discussed at the CNRE meetings, valuable conclusions can be drawn concerning the state-of-the-art of R and D as well as the present level and expected role of biomass energy sources in the energy supply of the European region.

48411 (EUR–12517) **Impact of renewable derived fuels on energy and agriculture sectors: Final report.** Killen, L. (Teagasc Agriculture and Food Development Authority, Dublin (Ireland). Rural Economy Research Centre); Dunne, W. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation; Teagasc Agriculture and Food Development Authority, Dublin (Ireland). Rural Economy Research Centre. 1989. 187p. Sponsored by Commission of the European Communities. Contract EN3V-0013-IRL(GDF). Source: NTIS (US Sales Only), PC A09/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 15.

The object of this study is to assess the implications for both the energy and agriculture sectors of producing fuels from agricultural feedstocks. The crops under consideration are conventional agricultural crops and forestry crops, and the fuel types are liquid fuels (ethanol, methanol and vegetable oil) and also solid fuel for combustion. Estimates have been made of financial and energetic outputs for sixteen different types of conventional agricultural crops as potential energy feedstocks. It has been found that there are substantial differences between potential feedstocks in terms of the energy required to produce them and the energy they produce per unit area. For example, root crops, although they have a high energy requirement, also produce a high energy output per unit area. Nevertheless, the energy output/input ratio for beet is remarkably similar to that for cereals. In terms of cost per hectare to produce feedstocks, there is almost a threefold difference, but on the cost per unit of energy produced, the results are quite similar. A linear programming model has been developed to optimise the production of ethanol from agricultural crops. This model has been constructed to address several problems. Firstly, there is the problem of seasonality of production of agricultural crops, some of which can and some of which cannot be stored. Secondly, there is the obvious conflict between economies of scale of processing plant and transport costs of the feedstocks. 90 refs., 22 figs., 66 tabs.

0908 Production

Refer also to citation(s) 48411

48412 (FERIC–HB07) **Handbook for small-to-medium size fuelwood chipping operations.** Folkema, M.P. Forest Engineering Research Inst. of Canada, Pointe Claire, PQ (Canada). Oct 1989. 52p. (CE–03116). Source: Forest Engineering Research Institute of Canada, 143 Place Frontenac, Pointe Claire, PQ, CAN H9R 4Z7. Prices: $27.00 CAN.

This report covers all aspects of small/medium chipping operations including chipping, wood procurement, stumpage costs, skidding/forwarding, constraints on transportation and chip dumping, quality and measurement of fuelwood chips, and pricing. The information given is based on case studies of existing operations and trials conducted in Atlantic Canada and Maine during December 1987 to May 1988. These operations typically produce up to 10,000 metric green tonnes (mgt) of fuelwood chips per year; this compares to 30,000 to 50,000 or more mgt/yr for a typical, mechanized, large-scale operation. Fuelchips from small/medium operations are used in biomass burning facilities in schools, hospitals, greenhouses, factories, etc. which burn 500 to 5000 or more mgt/yr. Such installations have been build in many parts of Atlantic Canada in the past six years; they are not yet common in other parts of Canada because other lower-priced forms of energy are available. The report emphasizes that investment in harvesting/chipping equipment should be proportional with the annual chipping volume. 13 refs., 82 figs., 9 tabs.

0909 Processing

Refer also to citation(s) 48411, 48439, 48842, 49105

48413 (DOE/ER–0469P) **Annual report and summaries of FY 1990 activities.** USDOE Office of Energy Research, Washington, DC (USA). Energy Biosciences Div. Sep 1990. 95p. Sponsored by U.S. DOE Energy Research. Order Number DE90018050. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The Energy Biosciences (BE) program encompasses research on the basic mechanisms of plants and microbes designed to provide the underpinning for future novel biotechnologies applicable to plant productivity, bioconversion processes and biology based energy conservation measures. The information base being garnered is also designed to gain understanding relevant to environmental problems. For example, an enhanced understanding of the capabilities of microorganisms to perform metabolic conversions may lead to new bioremediation procedures. Thus the body of data produced by BE program efforts has several critical impact areas. While the program is not involved with the near-term application of the information, the interactions and exchanges between BE basic researchers and users of the information is encouraged. Other units in the Department of Energy (DOE) and in industry are responsible for work on applications and process development.

48414 (EUR–11382, pp. 27-34) **The pyrolysis technology a perspective for the future.** Grassi, G. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

The test operation of the pyrolysis plant at Raiano was supervised by experts of the Commission during October 1987 and January 1988. This paper presents a summary of the detailed economical evaluation of Prof Bridgwater, of the technical results from Consortium Alten, of the evaluations and experiments of Doctors Churin and Antonelli. This evaluation is also the result of more than one year of experiments and 250 interventions on the plant. Other envisaged modifications will further improve the conversion process.

48415 (EUR–11382, pp. 35-48) **The LEBEN project as an example of an integrated agro-energy approach.** Gheri, F. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

With the technical and financial support of the Commission of the European Community, the Abruzzo Region is implementing an integrated project of exploitation of renewable energy resources whose aim is to develop the conventional and innovative agriculture and agro-industrial sectors. The project was approved by the Regional Government in 1984, and will be implemented by 1995. The Regional Development Program envisages the implementation of a diversified actions program to: improve the exploitation of potential productivity; balance the different social-economic regional situations; and increase employment. A specific action in the renewable energy section is envisaged within the Regional Development Program with the aim of using the local resources to revive the internal areas and to provide the agriculture production activities with energy at a lower price than conventionally.

48416 (EUR–11382, pp. 49-53) **Project LEBEN - Galicia (Spain): Energy exploitation of biomass.** Medina, E. (Union Electrica Fenosa, Madrid (Spain)). Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

The reasons which led Union Fenosa to become the promoter of a project to exploit the forest biomass in Galicia for energy producing purposes are explained. Different considerations were given to the availability of biomass in both quantity and quality in this region as well as assuring the exploitation of the pyrolysis process in order to demonstrate on a large scale its competitiveness with other commercial combustible products, especially fuel oil obtained from petroleum. Of equal importance, an exposition of the project in its first two stages is shown: the preliminary studies and the realization of an industrial experience demonstrating various aspects such as scope, organization, cost, financing and planning. The authors hope to give an overview of the project to be undertaken by UNION FENOSA in cooperation with other companies interested in a better solution to energy as well as forestal and environmental problems and in improving the standard of life of the population in Galicia.

48417 (EUR–11382, pp. 65-68) **Pyrolysis technology and products - Introduction.** Molle, J.F. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

Three main solutions could be envisaged for grassland abandoned by agriculture: idle; extensive production of meat and short rotation forestry. The third one is seen according to current calculations as the more attractive. Energy outlet could absorb the large quantity of biomass produced either through local direct combustion for large plants or charcoal slurry for widespread small size users. This study shows that pyrolysis has a specific place in large agroenergy projects. However this place must be carefully defined in a logical way. Annexes are proposing some questions in order to help to implement this. It must be stressed that such pyrolysis technologies are of particularly relevance to developing countries mainly as far as valorization of agrifood by-products to save firewood is concerned.

48418 (EUR–11382, pp. 69-76) **The pyrolysis for biomass is available in industry-scale and ready for the production of energy.** Hammer, H. (WIP, Munich (West Germany)). Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

For centuries, the first pyrolysis technique of energy from biomass has been in use world-wide for the small-scale production of charcoal. Today, industry-scale pyrolysis plants differ according mainly to the form of energy wanted, but also to the raw material input. Using bio-raw material, reactors for combined charcoal and gas production are available. Because of the possibility to store liquid fuels, there is an emphasis on producing oil from biomass in pyrolysis plants. With low temperature pyrolysis or conversion, a maximum of directly usable hydrocarburate oil is obtained.

48419 (EUR–11382, pp. 77-89) **Advanced biomass pyrolysis technology in the US.** O'Neil, D.J. (Georgia Institute of Technology, Atlanta (USA)); Kovac, R.J. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

Biofuels fulfills 3-4% of the primary energy demand annually in the US. The principal technologies accounting for this contribution are direct combustion of wood fuels, alcohol fuels production of octane-enhancing gasoline additives, electric power generation from municipal solid waste combustion, and methane recovery from landfills. The potential contribution to US annual energy demand in the year 2000 from these technologies has been estimated at 5-15% by the federal government. If advanced biomass conversion technologies, such as liquefaction (pyrolysis), are developed adequately the projected contributions of biomass to energy supplies could exceed 20% of US national demand by the turn of

the century. This paper surveys the current status of research, development and demonstration of biomass liquefaction technology in the US. Three principal process types, for the production of liquid fuels directly from biomass, are considered. Applicable economic assessments are cited.

48420 (EUR–11382, pp. 90-98) **Biomass pyrolysis technology and products. A Canadian viewpoint.** Hayes, R.D. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

This paper presents four views on pyrolysis, including an international view, a technical review, a strategic point of view, and a general Canadian bioenergy overview. From a basic definition of pyrolysis as the thermal conversion of material in the absence of oxygen, the following discussion includes vacuum, atmospheric and pressurized pyrolysis technologies for the production of gas, liquid, or char products.

48421 (EUR–11382, pp. 101-114) **Advanced vacuum pyrolysis project: State of the art and perspectives.** Lemieux, R.R. (Universite Laval, Quebec City, Quebec (Canada)); Kaliaguine, S.; Pakdel, H.; de Caumia, B.; Blanchette, D. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

A process for the pyrolysis under vacuum of biomass and waste materials is under development since 1978 in Canada. Background data regarding the yields and qualities of the pyrolysis products derived from such materials as wood, bark, agricultural residues, peat, municipal solid wastes, activated sludges and scrap tires, have been obtained at the bench scale level. A Process Development Unit having a feedthrough capacity of up to 25 kg h^{-1} and using a multiple hearth furnace reactor has been designed and built. One feature of the process is the production of high yields of pyrolysis oils and a reactive charcoal from wood. The pyrolysis oil can be separated from the aqueous phase using a proper condensation scheme at the outlet of the reactor. Moreover the wood-derived oils can be fractionated in different cuts at the six outlets of the multiple hearth furnace. The characteristics of this oil widely vary from top to bottom of the reactor. The value of these oils has been investigated in terms of heating fuel and as a source of commodity and high-value chemical content. At 10 Can $ t^{-1} for the supply of wood feedstock, the process seems to be feasible. The process feasibility significantly improves if commodity and high-value chemicals are extracted from the pyrolysis oils and sold as by-products.

48422 (EUR–11382, pp. 115-124) **Thermal conversion of biomass to liquids by the Waterloo Fast Pyrolysis Process.** Scott, D.S. (Univ. of Waterloo, Ontario (Canada)); Piskorz, J.; Radlein, D. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

A number of aspects of the Waterloo Fast Pyrolysis Process for the production of liquids from biomass are discussed. The conclusion from these studies is that the Waterloo Fast Pyrolysis Process is at the present time one of the most economical methods of thermally converting wood to an alternative fuel oil. Further, the oil is a potential source of several valuable chemicals and wood by-products.

48423 (EUR–11382, pp. 138-143) **A pyrolysis mill for fast pyrolysis of biomass.** Reed, B. (Colorado School of Mines, Golden (USA)); Cowdery, C.C. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

Conventional pyrolysis produces charcoal, pyrolysis oil and gas in approximately equal proportions. However fast pyrolysis has the potential for producing over 60% of an organic pyrolysis oil from biomass. The oil can be used as a low grade boiler fuel or the vapors can be converted to gasoline-like fuels. However, this requires high rates of heat a transfer. Heat transfer can be greatly enhanced by contact between biomass and hot solid surfaces. A pyrolysis mill has been developed to produce pyrolysis oil from biomass particles. Preliminary data from operation of the mill is presented.

48424 (EUR–11382, pp. 147-158) **Development of charcoal making processes in France.** Vergnet, L. (Centre Technique Forestier Tropical, Marne (France)); Corte, P. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

The French timber situation is a paradoxical one: although with 14 million hectares, France has more woodland than any other European country, her imports of timber, paper pulp and even charcoal are massive. The combination of a paradoxical domestic situation together with economic opportunities and the energy crisis factor has given rise to a large number of ventures in both the public and private sectors, which are now beginning to bear fruit. France is well-equipped with ancillary operating technology which is already playing a significant part in the recovery of the domestic market, and which has an evident part to play in tackling problems met in many other countries. A short review of the charcoal production situation and a survey of the various initiatives developed during the 1980's will be followed by a brief introduction to the operating technology mentioned above.

48425 (EUR–11382, pp. 159-166) **Characterization and upgrading of pyrolytic oils.** Churin, E. (Universite Catholique de Louvain (Belgium)); Maggi, R.; Grange, P.; Delmon, B. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

Pyrolytic oils produced in a demonstration unit were fractioned by liquid chromatography. The first two fractions are very useful in the characterization of this kind of oil because they comprise hydrocarbons in the first one and monophenols in the second. A very large number of hydrocarbons contained in these two fractions have been identified and a series of long-chain aliphatic hydrocarbons have been detected for the first time in pyrolytic oils. Bio-oils are very bad fuels but the drawbacks can be eliminated or strongly diminished depending on the severity of the process and by treatments under high pressure of hydrogen in the presence of catalysts. Nickel molybdenum and cobalt-molybdenum are very performant. A pretreatment at temperatures lower than the reaction temperature greatly improved the conversion.

48426 (EUR–11382, pp. 167-174) **Pyrolysis liquids: Problems and opportunities for utilization.** Bridgwater, A.V. (Aston Univ., Birmingham (England)); Double, J.M. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large

agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

Liquid products may be thermochemically produced from biomass by several routes including pyrolysis, direct liquefaction, and indirect synthesis via gasification. The pyrolysis process produces solid char, a MHV fuel gas and a crude organic liquid known as bio-oil. The proportions of these three products vary according to process conditions. The liquid product is viewed as the most valuable but has several characteristics that can make direct utilization difficult, so some form of upgrading may be desirable. This paper summarizes the status and characteristics of pyrolysis technologies, products, and upgrading technologies, and provides some preliminary economics.

48427 (EUR–11382, pp. 175-177) **Pyrolysis of biomass for the production of char, oil and gases.** Knight, J.A. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

The pyrolysis of biomass has been investigated worldwide during the past twenty years as a process to convert a wide variety of biomass species into more useful energy forms - char, oil and gas. At the present time, the technical studies of biomass pyrolysis can be categorized roughly into basic or fundamental research, developmental research, and pilot plant work. The particular objectives of an organization which supports the utilization of biomass as an alternative energy source will determine which technical areas are to be supported and funded. In the early seventies, the pyrolysis of biomass research and development work was directed toward the development of continuous processing of the feedstock to produce char, oil and gases. Reactor types included the packed or fixed bed, rotary kiln and fluidized bed. Starting in the late seventies, much of the research and developmental work has been directed toward fast (or flash) pyrolysis with the objective of producing greater oil yields. Currently, there is considerable emphasis on the catalytic treatment of pyrolytic oil to upgrade the oil to a hydrocarbon type fuel.

48428 (EUR–11382, pp. 178-182) **Pyrolysis of biomass - A vertical flow packed-bed system: Production of char, oil and gases.** Knight, J.A. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

The pyrolysis of biomass produces char, oil, water and gases. The yields of the products depend upon the biomass species and the processing conditions. A variety of biomass species have been used as feedstocks in experimental and developmental work of pyrolysis processes with considerable attention being given to forestry products and their residues and agricultural residues which are generated in large quantities during the processing of agricultural products. There is a large body of technical literature and data on the pyrolysis of different biomass species and processing technologies, which cover topics from the fundamental aspects of pyrolysis to the utilization of pyrolysis processes for industrial applications. The vertical flow packed-bed system, developed by the Georgia Institute of Technology and the Tech-Air Corporation will be discussed as an example of a workable technical process.

48429 (EUR–11382, pp. 183-191) **Alten activities in the field of biomass exploitation for energetic uses.** Fonzi, F.; Antonelli, M. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

Biomass exploitation problem for energetic uses is faced by Alten with the following programs: fluid bed pyrolysis process development; charcoal and bio-oil utilization as fuels; demonstration test of bio-oil and charcoal use on the Avezzano power station; and pyrolytic waters treatment.

48430 (EUR–11382, pp. 195-196) **Flexibility of mass produced engines as shaft power and electricity conversion carriers for biomass derived fuels.** Bonino, G. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

The effective operational and economical performance of pyrolysis plants as a basic technology for large agro-energy projects is also largely depending on the degree whereby part of the pyrolysis products, namely gas and oils, can be suitably used as fuel to supply the electrical energy and the shaft power demand of the process itself. Therefore the average pyrolysis plant should be totally self-sustained by its biomass conversion products. To respond to this and similar issues in the field of alternative fuels a Working Group is operating in Italy including institutions and companies. The first basic assumption of the working group is that mass production engines of Diesel and Otto cycle, are the only economically available and flexible industrial commodity to provide shaft power or to drive the alternator also by means of alternative and renewable fuels, at least in the next 15 ÷ 20 years forecast.

48431 (EUR–11382, pp. 197-204) **Research on sweet sorghum (Sorghum Bicolor).** Belletti, A. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

On the basis of cultivation and sweet sorghum industrial transformation experiences which occurred during the war period, an experimental program, supported by the Forli administration, was started on this plant in 1980, first in the district of Forli, then in Emilia Romagna. The first objective was to verify the productive capacity of local varieties cultivated for a fodder aim, but containing some monosaccharides. However, after the first results it was found necessary to investigate the possibility of introducing bred varieties to produce monosaccharides. From the beginning, the experimental work was based on such a scheme: agronomic and cultivation problems (production of raw materials), harvesting, storage and industrial working that closed the cycle. This planning was made possible by the collaboration with a distillery, which, in the period 1939-45, produced ethanol from sweet sorghum.

48432 (EUR–11382, pp. 205-210) **Technique of carbonization and pyrolysis.** Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

In 1984 Bio-Carbon changed its name to Bio-Alternative S.A., its aim then being the realization, manufacture and commercialization of ready-to-use pyrolysis units. The process developed by B.A.S.A., working in collaboration with a specialized laboratory set up within the Institute of Chemistry at Neuchatel University, is the recuperation of the energy contained in the biomass by the process of pyrolysis, a classic and well-known procedure. However

B.A.S.A. does not merely treat wood or wood shavings: its originality lies in the fact that the company has launched itself into the transformation of various other biomasses such as straw, grape stalks, coffee and cocoa husks, corn chaff, pine cones, refuse from large stores, household garbage and even diapers and other vegetable waste hitherto totally unexploited in many parts of the world. The stated aim is industrial exploitation with continuous production of solids, (organic carbon), liquids (oils and tars), and gases.

48433 (EUR–11382, pp. 211-215) **High pressure thermobalance device application to the gasification of char obtained from tropical wood.** Richard, J.R.; Rouan, J.P. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

Significant advances have been made in vacuum microbalance technology. However, thermogravimetric measurements at high pressure and temperature have received much less attention. In this paper the authors present the main features of a balance designed to operate at temperature and pressure as high as 1,300 K and 8 MPa. These values cover the range of many practical chemical processes. Preliminary results on char gasification in oxidizing atmospheres are given.

48434 (EUR–11382, pp. 216-220) **Thermochemical conversion of biomass: A study on the pyrolysis of biomass.** Lucchesi, A. (Universita' di Pisa (Italy)); Maschio, G. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects.* Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

The thermal treatment of biomass in absence of oxidizing agents is known as pyrolysis, the pyrolysis is a very important process to produce solid, liquid, and gaseous fuels, and is the first step of combustion and gasification processes. The understanding of the govern pyrolysis mechanisms and the knowledge of their rate and distribution of products is extremely useful for the development of the conversion processes of biomass and the proper design of the reactor for their realization. Experimental studies carried out in bench-scale reactors and pilot plant reveal the role of the most significant process parameters: temperature, solid residence time, particle size, chemical composition of feedstock, heating rate. The values of these parameters strongly influence the rate of pyrolysis as well as the distribution of products. In this paper they present the experimental results obtained in a conventional pyrolysis process and a fast pyrolysis process.

48435 (EUR–12480) **Catalytic treatment of pyrolysis oils.** Churin, E. (Louvain Univ., Louvain-la-Neuve (Belgium). Unite de Catalyse et Chimie des Materiaux Divises). Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation; Louvain Univ., Louvain-la-Neuve (Belgium). Unite de Catalyse et Chimie des Materiaux Divises. 1990. 40p. Sponsored by Commission of the European Communities. Contract EN3B-0166-B(CH). Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg.

This report describes ideas on pyrolysis of biomass and the upgrading of pyrolytic oils, including reactors, catalysts, and temperature effects. 34 refs., 7 figs., 9 tabs. (CBS)

48436 (OE/RT–90-03626-Vol.2, pp. 173-184, Paper C18) **Municipal solid waste feasibility of gasification with plasma arc: Phase 2. Environmental analyses.** Tsangaris, A.V. (Resorption Canada Ltd., Gloucester, ON (Canada)). Ontario Ministry of the Environment, Toronto, ON (Canada). Research and Technology Branch. 1989. (CONF-8911230–: Environmental research: technology transfer conference, Toronto (Canada), 20-21 Nov 1989; MICROLOG–90-03625). In *Proceedings [of the] Environmental research: Technology transfer conference: Volume 2. Liquid and solid waste, analytical methods, environmental socio-economics.* Source: PC Publications Ontario, 880 Bay St, 5th Floor, Toronto, ON, CAN M7A 1N8; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $6.00 CAN; MF $10 CAN.

A proposal was submitted to the Ontario Ministry of Energy by Resorption Canada Limited, OBOE Engineering Limited and Ontario Hydro for funding support for a feasibility study to investigate the gasification of municipal solid waste (MSW). The proposal was divided into two stages: stage one to determine the overall process heat balance and the higher heating value of the product gas; and stage two to assess the environmental acceptibility of the process as a whole including the combustion of the resultant gas. Results obtained and extrapolated to a commercial sized system indicate a conversion ratio of 4.3:1, an overall efficiency of 72.2% and a higher heating value of 282.15 Btu/ft ^{3} (max) for the product gas. The environmental aspects of the process which will be investigated will include: analysis of the product gas, the condensate extracted from the product gas, and the products of combustion of the product gas for polychlorobiphenyls, hydrogen ion activity, conjugate bases, cyclopentadienyls and other organics, acid gases and trace metals; and analysis of the resultant slag for trace metals and leachate toxicity. The benefits and disadvantages of this MSW gasification process are listed. 3 figs.

0920 Combustion

Refer also to citation(s) 48417, 48419, 48429, 48430, 48441, 48816, 48828

48437 (PB–90-251992/XAB) **Relationship of fuel size and spacing to combustion characteristics of laboratory fuel cribs. Forest Service research paper.** Anderson, H.E. Forest Service, Ogden, UT (USA). Intermountain Research Station. Jul 1990. 12p. (FSRP/INT–424). Source: NTIS, PC A03/MF A01.

Flaming combustion in cribs of large woody fuels, thickness 5cm or greater, is not sustained when fuel spacing ratio, fuel edge-to-edge separation distance to fuel thickness, is greater than 3:1. The flame length associated with the large-fuel burning rate was found to drop rapidly when the large-fuel spacing ratio increases beyond 2.23:1. This supports the critical spacing assigned in the large-fuel subroutine burnout of Albini's fire modeling program.

48438 **On reduced mechanisms for methane-air combustion in nonpremixed flames.** Bilger, R.W. (Sydney Univ. (Australia)); Starner, S.H.; Kee, R.J. *Combustion and Flame (USA),* 80(2): 135-149 (May 1990).

A four-step mechanism for the combustion of methane in air in nonpremixed flames is obtained by making steady-state and partial equilibrium approximations for minor species. The model gives good predictions of laminar flame structure, including steady-state minor species, for a wide range of flame stretch and across the whole breadth of the reaction zone, including rich mixtures. A good prediction of extinction is obtained. Further reduction to a three-step or two-step mechanism is discussed.

0930 Economic, Industrial, and Business Aspects

Refer also to citation(s) 48410, 48411, 48414, 48415, 48416

48439 (CRFA–90-01413, pp. 1-7, Paper 5) **Canadian experience with renewable fuels.** Meyer, A. (Mohawk Oil Co., Burnaby, BC (Canada)). Canadian Renewable Fuels Association (Canada); Biomass Energy Inst., Inc., Winnipeg, MB (Canada). [1989]. (CONF-8910455–: Let's clear the air, Toronto (Canada), 18 Oct 1989; MICROLOG–90-01413). In *Let's clear the air.* Source: PC Biomass Energy Institute Inc., 1329 Niakwa Road East, Winnipeg, MB, CAN R2J 3T4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

In October 1981, an old whisky plant in Minnedosa, Manitoba was converted to an ethanol manufacturing concern. In addition to barley, many damaged types of grains are processed: corn, wheat, hull-less barley, sprouted rye, and others. Cellulosic feed-stocks, such as corn stalks, wheat straw, or wood, have been considered as a target by the plant, Mohawk Corporation. Feed-stock prices have been high and low in various years, and this has not always coincided with highs and lows in gasoline prices, which have been the governing factor in determining the selling price of ethanol. In 1987 and 1988, Mohawk Corporation began, for the first time, to sell ethanol for octane rating enhancement.

0950 Environmental Aspects

Refer also to citation(s) 48844

48440 (CRFA–90-01413, pp. 1-11, Paper 1) **How renewable fuels contribute to clean air.** Vaughn, E. (Renewable Fuels Association, Washington, D.C. (USA)). Canadian Renewable Fuels Association (Canada); Biomass Energy Inst., Inc., Winnipeg, MB (Canada). [1989]. (CONF-8910455–: Let's clear the air, Toronto (Canada), 18 Oct 1989; MICROLOG–90-01413). In *Let's clear the air.* Source: PC Biomass Energy Institute Inc., 1329 Niakwa Road East, Winnipeg, MB, CAN R2J 3T4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper is about the role of the alternative fuels ethanol and ethanol-derived ethyl tertiary butyl ether (ETBE) in meeting environmental objectives such as the reduction of pollution due to carbon monoxide, carbon dioxide and ozone in metropolitan areas. Statistical data about the U.S. fuel ethanol industry are recalled. Over the past 10 years, ethanol-blended fuels have won wide consumer acceptance as a high-octane, high-performance gasoline additive: today, gasoline/ethanol-blend sales represent over 8% of all the motor fuels sold in the U.S.A. The air quality benefits of ethanol and ETBE are discussed. Ethanol-blends reduce substantially (by about 22%) the emissions of carbon monoxide, because of the high oxygen content of ethanol (the oxygen content of gasohol is about 3.5wt %). Computer simulations of urban areas, taking into account the time-dependent chemistry associated with hydrocarbon emissions, indicate that ethanol-blends do not perform worse than gasoline with respect to the concentrations of ozone that are reached. The impacts of the phasing-down of tetra-ethyl lead and of the increase of aromatic content in gasolines are discussed. A proposal is made for the formulation of oxygenated gasolines. The advantages of ETBE over methanol-derived MYBE (methyl tertiary butyl ether) are summarized. In conclusion, ethanol and ETBE have significant environmental benefits and act as effective octane-rating-enhancer alternatives for toxic tetra-ethyl lead and aromatic compounds. 2 tabs.

48441 (OMNI–90-03966) **Accelerated sample processing 1988-89. Phase 3, Northeast Cooperative Woodstove study: Final report.** OMNI Environmental Services, Inc., Beaverton, OR (USA). Jun 1989. 14p. Contract EMR 23440-8-9170. (MICROLOG–90-03966). Source: PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Particulate stack emissions were measured from 25 new-technology stoves installed in homes in the Glens Falls, NY area. Five stove brands, three catalytic and two non-catalytic, were selected for the study based on their performance in a laboratory durability test. Each stove was sampled for five weekly periods spanning from early January to late March. This type of sampling schedule provided an opportunity to document trends in stove emissions over the heating season as well as average performance. The average particulate emissions for the burning season from the best-performing catalytic woodstove, the Country Flame, was about 5 g/h. This represents a 75% decrease in emissions compared to conventional woodstoves. Two brands of non-catalytic stoves averaged about 10 g/h particulate emissions, about 50% better than conventional stoves. The performance of these stoves demonstrates that some current technology is capable of reducing particulate emissions from woodstoves quite significantly. The study also revealed that two of the catalytic brand stoves which had earlier passed a laboratory stress test did not perform up to expectations. The two non-catalytic stoves did not display performance degradation but both developed some premature oxidation and warping problems in the primary combustion chamber. 9 figs.

48442 (PNL-SA–17279) **Frequency profiles of residential wood burning for the northwestern United States.** LeBaron, B.A.; Jo, J.; Pearson, E.W. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 11p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract AC06-76RL01830. (CONF-8911222–1: 26. PNWIS Pacific Northwest international section's annual meeting, Spokane, WA (USA), 8-10 Nov 1989). Order Number DE90017188. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Surveys report that as high as 62% of the homes in the Pacific Northwest region have wood-burning equipment (the capability to heat with wood). Most of these homes apparently make use of this heating source. For example, the Oregon Department of Energy's Residential Energy Conservation Survey estimated that 50% to 60% of Oregon's households burn at least some wood. However, the number of homes that burn wood as their primary heating source is only about 21%. While it may be unclear whether wood heating will continue to enjoy popularity in light of recent energy price declines, certainly the hardware for wood heating remains widespread throughout the Northwest. For regulation purposes it is important to understand the impact this large capacity for wood heating can have on air quality. There is very little open literature describing wood usage patterns, apparently because of the difficulty and capital cost in monitoring residences for frequency and duration of burning. Analyses have typically used homeowner surveys of wood use to determine wood heating behavior. The weakness here is that survey responses are often unreliable. For example, respondent estimated wood usage may represent more of an indicator of the propensity to burn wood than the quantity actually burned. Characterizing wood usage patterns is important in assessing its contribution to air pollution. It may even be possible to use this information to predict when wood stove emissions will have their greatest impact on air quality. In this paper we present an examination of patterns of wood use for residential space heating in the Northwest. It is taken from a study of electrical energy consumption that is concerned with wood heating behavior from a standpoint of electrical displacement rather than one of air quality. 8 refs., 6 figs., 1 tab.

0970 Legislation and Regulations

Refer also to citation(s) 48442

0990 Products and By-Products

Refer also to citation(s) 48411, 48418, 48419, 48420, 48421, 48422, 48423, 48424, 48425, 48426, 48427, 48428, 48429, 48432, 48433, 48434, 48845

10 SYNTHETIC FUELS

1009 Environmental Aspects

Refer also to citation(s) 48844

13 HYDRO ENERGY

48443 (CSCE–CE03117) **Eighth Canadian hydrotechnical conference: Proceedings.** Canadian Society for Civil Engineering, Montreal, PQ (Canada). 1987. 773p. (CONF-8705408–: 8. Canadian hydrotechnical conference, Montreal (Canada), 19-22 May 1987; CE–03117). Source: Canadian Society for Civil Engineering, 2050 Mansfield St., Montreal, PQ, CAN . Prices: $30.00 CAN.

Proceedings on hydrotechnics were held to discuss the history of hydrotechnics, hydraulic structures, Northern regions (including ice problems), water resource planning, floods, hydrology (statistical aspects and modelling), sedimentation, river hydraulics, urban hydraulics, storm water management, gravel-bed rivers, river models, and mixing in reservoirs. Separate abstracts have been prepared for 7 papers, which deal specifically with hydroelectric power plants and with ice problems on Arctic structures.

48444 (CSCE–CE03117, pp. 96-119) **A brief introduction to Revelstoke Project.** Salmon, G.M. (BC Hydro, BC (Canada)). Canadian Society for Civil Engineering, Montreal, PQ (Canada). 1987. (CONF-8705408–: 8. Canadian hydrotechnical conference, Montreal (Canada), 19-22 May 1987; CE–03117). In *Eighth Canadian hydrotechnical conference: Proceedings*. Source: Canadian Society for Civil Engineering, 2050 Mansfield St., Montreal, PQ, CAN . Prices: $30.00 CAN.

This paper reports on the 2700 mW Revelstoke hydroelectric power plant on the Columbia River in British Columbia. This plant, with its 175 m concrete gravity dam, is one of the largest in North America. The project is described in terms of location, project arrangement, and includes statistics on its physical dimensions. The construction of the plant is reviewed including planning decisions on type of dam, site selection, layout, generating capacity, and river diversion. Details on the project's design center on the diversion tunnel, the upstream Cofferdam, the spillway, earthfill and concrete dams, intakes and penstocks, and the powerhouse. A summary of the plant's construction outlines production schedules, contract packaging, concrete and earthfill dam material requirements, and excavation and foundation treatment. The generating station and associated structures have performed satisfactorily to date and no design related operating problems are foreseen. 7 refs., 8 figs., 5 tabs.

48445 (CSCE–CE03117, pp. 3-21) **Hydroelectric installations: A priceless heritage.** Boyd, R. (Gendron-Lefebvre, Montreal, PQ (Canada)). Canadian Society for Civil Engineering, Montreal, PQ (Canada). 1987. (CONF-8705408–: 8. Canadian hydrotechnical conference, Montreal (Canada), 19-22 May 1987; CE–03117). In *Eighth Canadian hydrotechnical conference: Proceedings*. Source: Canadian Society for Civil Engineering, 2050 Mansfield St., Montreal, PQ, CAN . Prices: $30.00 CAN.

This article recalls some of the landmark developments of hydroelectric power in Canada, from the modest installations of the late 19th century to the most recent James Bay complex. The problems of logistics, energy transport, climates, and complex geological conditions are underlined, as is the original contribution of Canadian engineering to the solution of these problems. Canada is one of the few countries where hydroelectric power accounts for more than 2/3 of the production of electrical energy; the contribution of hydroelectric power to the production of electrical energy is only 23% world-wide. Statistical data are provided concerning hydroelectric dams in Canada and the world, the production of electrical energy in the Canadian provinces, and electricity rates in various countries. 14 refs., 4 figs., 4 tabs.

48446 (FRNC-R–161) **Small hydro-electric power stations.** Emont, D. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1986. 67p. (In FR, EN). Order Number DE91701148. Source: NTIS (US Sales Only), PC A04/MF A01.

This document reviews the various aspects of a small hydroelectric power station installation: evaluation of the electricity needs of a remote village, description of the various components of a micro-station, evaluation of the installation requirements, evaluation of the economic value of small power stations, financing systems, evaluation of water resources, geological site survey, water take off, dam and channeling system, the different types of turbines, generators, step-up gearing, control system. Examples are given.

1301 Resources and Availability

48447 (CSCE–CE03117, pp. 229-247) **Bottom ice, in situ and long term evaluation.** Desroches, P. (Hydro Quebec, Montreal, PQ (Canada)); Brosseau, G.; Carballada, L. Canadian Society for Civil Engineering, Montreal, PQ (Canada). 1987. (CONF-8705408–: 8. Canadian hydrotechnical conference, Montreal (Canada), 19-22 May 1987; CE–03117). In *Eighth Canadian hydrotechnical conference: Proceedings*. Source: Canadian Society for Civil Engineering, 2050 Mansfield St., Montreal, PQ, CAN . Prices: $30.00 CAN.

With regard to the possible harnessing of the Lachine rapids, one of the most extensively studied problems has been the abundant formation of bottom ice on the bed of the Saint Lawrence River and its effects on water flow and levels. So as to evaluate the impact of this problem on the operation of hydroelectric power plants, in situ observation programs have been carried out. The effect of bottom ice on potential energy generation has been evaluated by compiling time series of the variations of the relevant water levels. Both approaches, in situ observations and time series, aid in the determination of the impact of bottom ice on plant operation (short term) and on the reliability of power generation (long term). For example, at the Archipel project, which has a water head of 8.15 m in January, the upheaval at Pointe-Claire would be 0.46 m on average and 1.1 m as a maximum, and the upheaval in the tailrace would be 0.33 m on average and 1.4 m as a maximum. 14 refs., 5 figs., 3 tabs.

1303 Plant Design and Operation

Refer also to citation(s) 48672

48448 (CSCE–CE03117, pp. 249-267) **Operation of an isolated mini-hydro plant in northern Quebec.** Grande, N. (SNC, Montreal, PQ (Canada)); Georgekish, H. Canadian Society for Civil Engineering, Montreal, PQ (Canada). 1987. (CONF-8705408–: 8. Canadian hydrotechnical conference, Montreal (Canada), 19-22 May 1987; CE–03117). In *Eighth Canadian hydrotechnical conference: Proceedings*. Source: Canadian Society for Civil Engineering, 2050 Mansfield St., Montreal, PQ, CAN . Prices: $30.00 CAN.

This paper describes a 1.15 MW capacity hydroelectric plant installed to serve an isolated native community in Wemindji, James Bay, Quebec. Studies were carried out for a planning period of up to 50 years to determine the growth in load and energy demand, as functions of type of load and of the availability of different energy sources. In order to reduce the consumption of expensive and non-renewable diesel fuel, a hydroelectric site was identified on the Maquatua River, and a run-of-the-river plant was built. The design, construction and monitoring of the project are outlined. The operation of the power system, hydro plus diesel, is discussed along with the energy needs of the community and other available energy sources (such as wood and oil for heating). The project was financed by the Canadian government and the Wemindji Band Council, the construction was carried out by a local Cree construction company, and local personnel have been trained to operate the plant. The experience gained from this project shows that the construction and operation of a mini-hydro plant in an isolated community is technically and economically feasible. The mini-hydro plant has produced 3,067 MWh of energy during its first full year of operation, thereby saving the community 1,012 tonnes of diesel fuel, or $1.012 million. 3 refs., 6 figs., 7 tabs.

48449 (CSCE–CE03117, pp. 329-349) **Optimal arrangement of hydroelectric power systems.** Brosseau, G. (Hydro Quebec, Montreal, PQ (Canada)); Kang, N.; Lardeau, J.P. Canadian Society for Civil Engineering, Montreal, PQ (Canada). 1987. (CONF-8705408–: 8. Canadian hydrotechnical conference, Montreal (Canada), 19-22 May 1987; CE–03117). In *Eighth Canadian hydrotechnical conference: Proceedings*. Source: Canadian Society for Civil Engineering, 2050 Mansfield St., Montreal, PQ, CAN . Prices: $30.00 CAN.

This paper presents a methodology for simulating the optimization and management of hydro-electric power systems which has been developed by Hydro Quebec, using linear programming. This new approach, resulting from a combination of optimization (ATHENA code) and simulation (ENERGIE3 code), allows one to determine the least costly arrangement of the system which will satisfy a given energy demand. The sites to be harnessed are chosen with the following characteristics in mind: height of the crest of

the dam, minimum level of operation, restitution level, and, if appropriate, capacity of the turbines. This methodology was applied to the Ashuapmuchuan and the Romaine rivers. The results show that this methodology allows for the determination of at a preliminary stage, the least costly manner in which to develop a hydroelectric resource, plan its developmental stages, and reach its final economic potential. Recommendations are made on how to improve the ATHENA computer code. 7 refs., 9 figs., 13 tabs.

1305 Economic, Industrial and Business Aspects

Refer also to citation(s) 48754

1306 Environmental Aspects

48450 (OH/RD–89-235-K) **A study of Ontario Hydro's contribution to ozone levels in Ontario: Phase 1: Literature review.** Lin, X. Ontario Hydro, Toronto, ON (Canada). Research Div. 18 Oct 1989. 25p. (MICROLOG–90-03518). Source: PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

The frequent occurrence in high ozone, O_3, concentrations in rural areas in southeastern Canada has become of concern to the Canadian public. This paper discusses tropospheric O_3 photochemistry with special emphasis on nonlinear characteristics of O_3 production. The nonlinearity of O_3 production with respect to nitrogen oxide (NO_x) levels implies that NO_x, a precursor of O_3, emanating from major urban centres, power plants and other industrial complexes can play an important role in regional O_3 episodes in this region. Ontario Hydro, as one of the emitters of NO_x is strongly committed to understand its contribution to the problem and to take prudent measures to reduce its impact. To help fulfil these needs, a critical review of the literature was carried out. Development of a reactive plume model, including a comprehensive photochemistry package and implementation of a state-of-the-art regional oxidant model, are proposed. 68 refs., 4 figs., 3 tabs.

48451 (WAU/CGS–CE03140, pp. 196-207) **Stress-strain behavior of the LG 4 dam.** Massiera, M. (Univ. de Moncton, NB (Canada)); Boncompain, B.; Fakhri, Y.; Lessard, G. Canadian Geotechnical Society, Waterloo, ON (Canada). 1989. (CONF-891015–: 42. Canadian geotechnical conference, Winnipeg (Canada), 23-25 Oct 1989; CE–03140). In *Materials: From theory to practice: Proceedings.* Source: Canadian Geotechnical Society, University of Waterloo, Waterloo, ON, CAN . Prices: PRICES UPON REQUEST.

The LaGrande LG-4 dam, part of the James Bay hydroelectric project in Quebec, is 121.4 m high, about 3800 m long, and is composed of 19 million m^3 of fill materials. It is characterised by a zoned earth-rockfill section founded on bedrock. At the design stage of the LG-4 main dam, a detailed stress-strain analysis was performed in order to predict the deformation of the structure and to identify the potential zones of differential settlement and arching. After construction, two series of analyses were performed in order to better estimate the stress-strain parameters of the various material zonings, based on laboratory testing as well as the actual behaviour of the dam. The observed deformation and stress performance of the dam during construction, reservoir filling and subsequent operation period is presented. Relevant comparison is also made with the results of the finite element analysis carried out during design and after construction. 16 refs., 19 figs., 2 tabs.

48452 (WAU/CGS–CE03140, pp. 249-256) **The application of flexible jet grout for a cutoff at John Hart Dam.** Garner, S.J. (B.C. Hydro and Power Authority, Vancouver, BC (Canada)); Lee, M.K.; Kilpatrick, B.L.; Lou, J.K. Canadian Geotechnical Society, Waterloo, ON (Canada). 1989. (CONF-891015–: 42. Canadian geotechnical conference, Winnipeg (Canada), 23-25 Oct 1989; CE–03140). In *Materials: From theory to practice: Proceedings.* Source: Canadian Geotechnical Society, University of Waterloo, Waterloo, ON, CAN . Prices: PRICES UPON REQUEST.

The John Hart Dam on Vancouver Island, British Columbia consists of a concrete gravity dam, a concrete power intake structure and earthfill sections. The dam is in a high seismic risk area. To minimize the liquefaction potential of the foundation soils, a cutoff under the power intake structure was required. In order for the power plant to remain operational, the cutoff had to be constructed through the intake structure under normal reservoir conditons. Installation of a jet grout cutoff was selected to accommodate construction under full reservoir and normal operating conditions while being constructed in limited working space. To minimize the potential for cracking of the wall under large earthquakes, a flexible cement-bentonite mix was used. Strength and permeability laboratory testing together with field quality control testing were carried out to ensure that the jet grout had the required properties. Results of the jet grout tests are compared to results of tests on the identical cement-bentonite mix used in slurry panels under the adjacent earthfill dams. 3 refs., 13 figs.

1308 Health and Safety

Refer also to citation(s) 49729

48453 (OH/RD–89-173-K) **A data acquisition system for residential magnetic field source characterization.** Donnelly, K.E. Ontario Hydro, Toronto, ON (Canada). Research Div. 24 Oct 1989. 46p. (MICROLOG–90-03517). Source: PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

A Data Acquisition System has been designed and built to characterize the sources of residential magnetic fields. This source characterization program will establish the factors which determine the level of magnetic field exposure and their prevalence, contribute to the development of improved surrogate measures for epidemiological investigations, and suggest methods of reducing high values of field exposure, if required, by changes in grounding and distribution practices. The data acquisition system is portable computer based, and has three current monitoring channels, a 3-axis magnetic field probe, and an auxiliary magnetic field coil to monitor fields from inaccessible currents. Data on harmonics and phases are obtained. It is capable of recording unattended for extended periods of time. 15 figs.

14 SOLAR ENERGY

1405 Solar Energy Conversion

48454 (AD-A–222717/1/XAB) **Efficient photovoltaic devices for InP semiconductor/liquid junctions. Technical report.** Heben, M.J.; Kumar, A.; Zheng, C.; Lewis, N.S. California Inst. of Tech., Pasadena, CA (USA). Dept. of Chemistry. 24 Aug 1989. 5p. Contract N00014-88-K-0482. (TR–6). Source: NTIS, PC A01/MF A01.

Pub. in Nature, Vol. 340, 621-623(24 Aug 1989).

The photovoltaic behavior of n-InP/metal and n-InP/liquid junctions is investigated. We find that the electrical properties of these semiconductor/liquid junctions are superior to those of n-InP/metal (Schottky barrier) systems, and the current-voltage characteristics are a strong function of the electromechanical potential of the liquid phase. Liquid contacts thus provide a possibility for the construction of more efficient photovoltaic devices than those available at present from Schottky barriers.

48455 (AFME–82-066-7) **Solar energy photovoltaic conversion 1982-1985 research review.** Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France); Centre National de la Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matiernes Premieres (PIRSEM). 1987. 643p. (In French). (AFME–85-91-1002-7). Order Number DE91701155. Source: NTIS (US Sales Only), PC A99/MF A01.

A review of the PIRSEM research program on photovoltaic conversion is presented. The main themes of the 1982-1985 program

are: crystalline silicon technology (ionic incrustation, pulsed annealing joining, ribbon production with electron beam and pulsed electron annealing), multicolor technology (dichroitic separator two-cell systems (Ga As and Ge)); thin film technology (Cd S spray); high concentration technology (AsGa photocells, dichroitic systems); polycrystalline silicon technology (fabrication and effects of impurities); hydrogenated amorphous silicon technology.

48456 (AFME–83-2434) **Resistance of solar modules to environment constraints.** Barbier, J.P.; Leclercq, C. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France); Laboratoire Central des Industries Electriques (LCIE), 92 - Fontenay-aux-Roses (France). Jan 1986. 27p. (In French). Order Number DE91701147. Source: NTIS (US Sales Only), PC A03/MF A01.

The aim of this study was to develop standardized accelerated testing methods for solar photocells concerning their behaviour and response to environmental stresses: a bibliographic survey of environmental testing standards is first presented; then several testing methods are evaluated: humid and hot conditions, high temperature storage, temperature rapid variations, seasonal variations (dry heat, humid heat, cold, etc.). The module deterioration mechanisms are analyzed.

48457 (AFME–85-06-1096) **Calibration of photovoltaic cells and modules used for terrestrial applications.** Roussel, M. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France); Centre National d'Etudes Spatiales (CNES), 31 - Toulouse (France). Jan 1987. 74p. (In French). Order Number DE91701149. Source: NTIS (US Sales Only), PC A04/MF A01.

A calibration program for PV cells and modules, from industrial and laboratory production, has been realized. The various phases of the program are described: calibration of the measuring system, calibration of the PV cells and modules at the Flash solar simulator, and spectral response plotting.

48458 (AFME–85-09-1106-3) **Field trial procedure to assess the behavior of photovoltaic modules under natural condition.** Ang, T.G.; Winden, J.V.; Pongpimai, N.; Lasnier, F. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1986. 29p. Order Number DE91701154. Source: NTIS (US Sales Only), PC A03/MF A01.

A data acquisition system for a PV-module characterization bench is presented. It allows the monitoring of the I-V characteristics of different PV modules in a very short time (1 sec), ensuring that the insolation and module temperature remain constant during data measurement. Three procedures were adopted for the determination of the solar module equation parameters in the software (least square method, simple search method and stochastic method).

48459 (N–90-23662) **New directions in InP solar cell research.** Weinberg, I.; Swartz, C.K.; Brinker, D.J. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1990. 7p. (NASA-TM–103160;E–5528;NAS–1.15:103160;CONF-900801–: 25. intersociety energy conversion engineering conference, Reno, NV (USA), 12-17 Aug 1990). Source: NTIS, PC A02/MF A01.

Recent research efforts representing new directions in InP solar cell research are reviewed. These include heteroepitaxial growth on silicon and gallium arsenide substrates, V-grooved cells, large area high efficiency cells, and surface passivation. Improvements in heteroepitaxial cell efficiency are described together with processing of 19.1 percent, 4 sq cm cells. Recommendations are made for improvements in processing leading to increased efficiencies.

48460 (SAND–90-2272C) **Generic quality assurance/quality control guide for photovoltaic concentrator design, development and system installation.** Murty, V.S. (Texas Southern Univ., Houston, TX (USA)); Chamberlin, J.L. Sandia National Labs., Albuquerque, NM (USA). [1990]. 5p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. (CONF-9009238–1: National conference on energy research enhancement and technology transfer for industry and higher education, Kingsville, TX (USA), 16-18 Sep 1990). Order Number DE90017040. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The US Department of Energy National Photovoltaics Program considers the photovoltaic (PV) concentrator technology as a viable entity, likely to penetrate the utility market in the foreseeable future. To achieve this, it has launched the National Photovoltaic Concentrator Initiative under the management of Sandia National Laboratories. The objective of this program is to encourage PV concentrator system design and manufacture, with a view to bringing the energy cost to $0.12/kWh in the next four years and to $0.06/kWh by the year 2000. To achieve these goals, the systems have to perform reliably for 20 to 30 years. This necessitates a stringent quality assurance/quality control (QA/QC) program in all phases of PV concentrator design, production, and installation. In order to assist the PV industry in this effort a project was initiated to provide a generic QA/QC guide, capable of being adapted by any PV concentrator industry to prepare its individual QA/QC plan. The draft plan of the guide was prepared and circulated to various government laboratories and industries involved in PV concentrator work. Their input is now being incorporated into a final document, which will serve as an industry standard. 1 ref., 1 fig.

48461 (SERI/CP–211-3976) **SERI workshop on the role of point defects/defect complexes in silicon device fabrication: Book of abstracts.** Solar Energy Research Inst., Golden, CO (USA). [1990]. 35p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. (CONF-9008149–Absts.: SERI workshop on the role of point defects/defect complexes in silicon device fabrication, Keystone, CO (USA), 30-31 Aug 1990). Order Number DE90000377. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document is composed of abstracts from papers presented at a workshop on the role of point defects and defect complexes in silicon device fabrication. Among the topics covered are: defects in silicon; defect/impurity control in material growth and gettering impurities and defects in silicon solar cells impurity-defect interactions; defect passivation/process interactions and annealing gettering/defect passivation for silicon solar cells. (FSD)

48462 (SERI/TP–211-3906) **Research on high-efficiency, large area amorphous silicon based solar cells: Final subcontract report, February 1, 1989–February 28, 1990.** Arya, R.R. (Solarex Corp., Newtown, PA (USA). Thin Film Div.); Bennett, M.; Fieselmann, B.; Morris, J.; Newton, J.; Podlesny, R.; Twesme, E.; Wiedeman, S.; Yang, L.; Rothwarf, A.; Shapiro, F. Solar Energy Research Inst., Golden, CO (USA); Solarex Corp., Newtown, PA (USA). Thin Film Div. Sep 1990. 75p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Contract ZB-7-06003-2. Order Number DE90000356. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This document presents the results of studies in three areas: materials research, non-semiconductor materials research, and submodule research. In materials research, hydrogen dilution of a SiGe:H alloys improved alloys homogeneity and reduced light-induced degradation. Performance improvements were made in both microcrystalline and amorphous doped films, and a method was demonstrated that appears to overcome nucleation and film growth problems by recrystallizing the amorphous n-layer. In non-semiconductor materials research, ITO/Ag production was scaled up to successfully coat 1000-cm^2 submodules. Work on atmospheric chemical vapor deposition of zinc oxide produced 2-μm-thick films with 50–80 Ω/sq. sheet resistance. In submodule research, all processes were scaled up and single-junction submodules were prepared with 9.9% aperture-area conversion efficiencies. Triple-junction submodules were produced with 8.98% aperture-area efficiencies, and laser scribing was improved to allow only a 2% loss in area. Modeling was used to optimize module performance by predicting parasitic losses given the material constraints of a given device design. Modules were laser patterned to define an array of small-area devices, and topographic maps were produced to alloy visualization of both isolated defects and performance gradients. 27 refs., 41 figs., 7 tabs.

48463 (SERI/TP–211-3908) **Structure of amorphous-silicon and germanium alloy films: Annual subcontract report, January 15, 1989–January 14, 1990.** Norberg, R.E. (Washington Univ., St. Louis, MO (USA). Dept. of Physics); Fedders, P.A. Solar Energy Research Inst., Golden, CO (USA); Washington Univ., St.

Louis, MO (USA). Dept. of Physics. Aug 1990. 32p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Contract XB-7-06055-1. Order Number DE90000355. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The principal objective of this research program has been to improve the understanding at the microscopic level of amorphous silicon-germanium-alloy films deposited under various conditions to assist researchers to produce higher quality films. The method has been a joint theoretical and experimental approach to the correlation of NMR, ESR, and other characterizations, especially relating to rearrangements of hydrogen. Deuteron magnetic resonance reveals the presence of (and changes in) tightly bonded hydrogen (deuterium), weakly bonded hydrogen, molecular hydrogen, rotating silyl and hydrogen molecules trapped on nanovoid surfaces. Theoretical calculations show that there are serious errors in many computer simulations of amorphous solid Si and liquid Si. 25 refs., 10 figs., 5 tabs.

48464 (SERI/TP–211-3918) **Research on high-efficiency, multiple-gap, multi-junction amorphous silicon-based alloy thin-film solar cells: Final subcontract report, March 1, 1987–February 28, 1990.** Guha, S. (Energy Conversion Devices, Inc., Troy, MI (USA)). Solar Energy Research Inst., Golden, CO (USA); Energy Conversion Devices, Inc., Troy, MI (USA). Aug 1990. 146p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Contract ZB-7-06003-4. Order Number DE90000364. Source: NTIS, PC A08/MF A01 - OSTI; GPO Dep.

This report documents the results of material development, single- junction solar cell research, and high-efficiency multijunction cell development. High-quality a-Si:Ge:H:F alloys were made with optical band gaps as low as 1.3 eV; high-conductivity microcrystalline p^+ and n^+ doped alloys were developed with optical band gaps greater than 2 eV. A double-layer antireflection coating was developed, and the cell's quantum efficiency at 400 nm improved from 60% to 77%. A novel solar cell structure was developed using band gap profiling in the intrinsic layer to obtain high efficiency. Single-junction solar cells with a-SiGe:H alloys in the intrinsic layer were fabricated with active-area efficiencies of 9.7%. Dual-gap tandem cells were fabricated with active-area efficiencies of 13%, and triple-junction cells were fabricated with active-area efficiencies of 13.7%–the highest reported to date for any thin-film amorphous solar cell. Degradation rates of 12%–17% after 300 hours illumination were measured in triple-junction cells, a significant increase over the degradation of single-junction cells with comparable efficiencies. A triple-junction module with a subaperture area of 818 cm^2 was measured at SERI with a conversion efficiency of 8.4%. 27 refs., 72 figs., 15 tabs.

48465 Mild water stress effects on carbon-reduction-cycle intermediates, ribulose bisphosphate carboxylase activity, and spatial homogeneity of photosynthesis in intact leaves. Sharkey, T.D. (Univ. of Wisconsin, Madison (USA)); Seemann, J.R. *Plant Physiology (USA)*, 89(4): 1060-1065 (Apr 1989).

We have examined the effect of mild water stress on photosynthetic chloroplast reactions of intact Phaseolus vulgaris leaves by measuring two parameters of ribulose bisphosphate (RuBP) carboxylase activity and the pool sizes of RuBP, 3-phosphoglycerate (PGA), triose phosphates, hexose monophosphates, and ATP. We also tested for patchy stomatal closure by feeding $^{14}CO_2$. The k_{cat} of RuBP carboxylase (moles CO_2 fixed per mole enzyme per second) which could be measured after incubating the enzyme with CO_2 and Mg^{2+} was unchanged by water stress. The ratio of activity before and after incubation with CO_2 and Mg^{2+} (the carbamylation state) was slightly reduced by severe stress but not by mild stress. Likewise, the concentration of RuBP was slightly reduced by severe stress but not by mild stress. The concentration of PGA was markedly reduced by both mild and severe water stress. The concentration of triose phosphates did not decline as much as PGA. We found that photosynthesis in water stressed leaves occurred in patches. The patchiness of photosynthesis during water stress may lead to an underestimation of the effect of stomatal closure. We conclude that reductions in whole leaf photosynthesis caused by mild water stress are primarily the result of stomatal closure and that there is no indication of damage to chloroplast reactions.

1406 Photovoltaic Power Systems

Refer also to citation(s) 48460, 48755

48466 (AFME–85-05-1061) **Study of photovoltaic sites in the Alpes-de-Haute-Provence.** Michel, E.; Blondey, T.; Gadea, A. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). Jan 1986. 82p. (In French). Order Number DE91701150. Source: NTIS (US Sales Only), PC A05/MF A01.

Several sites in Provence (France) were evaluated for photovoltaic applications: remote farms, street lighting, illumination of monuments, radio relay station power supply, agricultural hydraulics, etc. In each case a feasibility study is presented: power requirements, selection and dimensioning of PV modules, financial and economical study.

48467 (N–90-24585) **Diode laser satellite systems for beamed power transmission.** Williams, M.D.; Kwon, J.H.; Walker, G.H.; Humes, D.H. National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center. 1990. 31p. (NASA-TP–2992;L–16669;NAS–1.60:2992). Source: NTIS, PC A03/MF A01.

A power system composed of an orbiting laser satellite and a surface-based receiver/converter is described. Power is transmitted from the satellite to the receiver/converter by laser beam. The satellite components are: (1) solar collector; (2) blackbody; (3) photovoltaic cells; (4) heat radiators; (5) laser system; and (6) transmission optics. The receiver/converter components are: receiver dish; lenticular lens; photocells; and heat radiator. Although the system can be adapted to missions at many locations in the solar system, only two are examined here: powering a lunar habitat; and powering a lunar rover. Power system components are described and their masses, dimensions, operating powers, and temperatures, are estimated using known or feasible component capabilities. The critical technologies involved are discussed and other potential missions are mentioned.

48468 (SAND–90-0390) **Terrestrial nickel/hydrogen battery evaluation.** Bush, D.M. Sandia National Labs., Albuquerque, NM (USA). Jul 1990. 12p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. Order Number DE90014863. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The nickel/hydrogen battery was developed in the 1970s as an energy storage subsystem for commercial communication satellites. The advantages offered by nickel/hydrogen batteries, including long life, low maintenance and high reliability, make it very attractive for terrestrial applications such as stand-alone photovoltaic systems. The major drawback to the wider use of the nickel/hydrogen battery is its high initial cost. Sandia National Laboratories has directed cost-shared contracts at Comsat Laboratories and Johnson Controls, Inc. to reduce the cost, and a battery consisting of prismatic cells in a common pressure vessel has evolved. Contract deliverables include cells and batteries that are evaluated at Sandia. This report summarizes the results over the past two years of both cycle and solar testing. 6 refs., 12 figs., 5 tabs.

1407 Solar Thermal Power Systems

48469 (DOE/NASA/33408–4) **Preliminary designs for 25 kWe advanced Stirling conversion systems for dish electric applications.** Shaltens, R.K.; Schreiber, J.G. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. [1990]. 14p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AT04-85AL33408. (NASA-TM–103188;CONF-900801–26: 25. intersociety energy conversion engineering conference, Reno, NV (USA), 12-17 Aug 1990). Order Number DE90017408. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Under the Department of Energy's (DOE) solar Thermal Technology Program, Sandia National Laboratories is evaluating heat engines for terrestrial Solar Distributed Heat Receivers. The Stirling engine has been identified by Sandia as one of the most promising engines for terrestrial applications. The Stirling engine also has the potential to meet DOE's performance and cost goals. The NASA Lewis Research Center is conducting Stirling engine technology development activities directed toward a dynamic power source for

space applications. Space power systems requirements include high reliability, very long lift, low vibration and high efficiency. The free-piston Stirling engine has the potential for future high power space conversion systems, either nuclear or solar powered. Although both applications appear to be quite different, their requirements complement each other. NASA Lewis is providing management for the Advanced Stirling Conversion System (ASCS) Project through a cooperative Interagency Agreement with DOE. Parallel contracts were completed in December 1989 by Cummins Engine Company (CEC), Columbus, Indiana and Stirling Technology Company (STC), Richland, Washington for the preliminary designs of an ASCS. Each design features a free-piston Stirling engine, a liquid metal heat transport system, and a means to provide nominally 25 kW of electric power to a utility grid while meeting DOE's performance and long term cost goals. The Cummins design incorporates a linear alternator to provide the electrical output, while the STC design generates electrical power indirectly through a hydraulic pump/motor coupled to an induction generator. Both preliminary designs for the ASCS's will use technology which can reasonably be expected to be available in the early 1990's. 14 refs., 7 figs., 2 tabs.

48470 (SAND–90-0097C) **Bench-scale testing of a heat-pipe receiver for solar thermal electric applications.** Adkins, D.R. (Sandia National Labs., Albuquerque, NM (USA)); Dudley, V. Sandia National Labs., Albuquerque, NM (USA). [1990]. 25p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901109–2: International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers, Dallas, TX (USA), 25-30 Nov 1990). Order Number DE90009834. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Electric power generating systems that couple parabolic-dish solar-concentrators with Stirling engines and generators are currently being developed under the Department of Energy's solar thermal electric program. These systems will use liquid metal heat pipes to transfer energy from the focal point of a solar concentrator to the heater tubes of a Stirling engine. The heat-pipe solar-receivers are required to operate in adverse orientations and accept flux levels on the order of 100 W/cm^2. To explore the operating limits of heat-pipe solar-receivers, a series of bench-scale heat pipe receivers are being designed and tested. Results from the bench-scale tests and their implications on a full-scale heat-pipe solar receiver are presented in this paper. 14 refs., 12 figs.

1408 Ocean Energy Systems

48471 (SERI/TP–253-3616) **Conceptual design of an open-cycle ocean thermal energy conversion net power-producing experiment (OC-OTEC NPPE).** Bharathan, D.; Green, H.J.; Link, H.F.; Parsons, B.K.; Parsons, J.M.; Zangrando, F. Solar Energy Research Inst., Golden, CO (USA). Jul 1990. 154p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE90000304. Source: NTIS, PC A08/MF A01 - OSTI; GPO Dep.

This report describes the conceptual design of an experiment to investigate heat and mass transfer and to assess the viability of open-cycle ocean thermal energy conversion (OC-OTEC). The experiment will be developed in two stages, the Heat- and Mass-Transfer Experimental Apparatus (HMTEA) and the Net Power-Producing Experiment (NPPE). The goal for the HMTEA is to test heat exchangers. The goal for the NPPE is to experimentally verify OC-OTEC's feasibility by installing a turbine and testing the power-generating system. The design effort met the goals of both the HMTEA and the NPPE, and duplication of hardware was minimal. The choices made for the design resource water flow rates are consistent with the availability of cold and warm seawater as a result of the seawater systems upgrade carried out by the US Department of Energy (DOE), the state of Hawaii, and the Pacific International Center for High Technology Research. The choices regarding configuration of the system were made based on projected performance, degree of technical risk, schedule, and cost. The cost for the future phase of the design and the development of the HMTEA/NPPE is consistent with the projected future program funding levels. The HMTEA and NPPE were designed cooperatively by PICHTR, Argonne National Laboratory, and Solar Energy Research Institute under the guidance of DOE. The experiment will be located at the DOE's Seacoast Test Facility at the Natural Energy Laboratory of Hawaii, Kailua-Kona, Hawaii. 71 refs., 41 figs., 34 tabs.

1409 Solar Thermal Utilization

Refer also to citation(s) 48828

48472 (DOE/SF/16306–23) **Colorado State University program for developing, testing, evaluating and optimizing solar heating and cooling systems: Project status report for the months of July and August 1990.** Colorado State Univ., Fort Collins, CO (USA). Solar Energy Applications Lab. 7 Sep 1990. 22p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG03-86SF16306. Order Number DE90017273. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper is a progress report for the period of July 1, 1990 to 31 August 1990 on activities at Colorado State University in a program for developing, testing, evaluating and optimizing solar heating and cooling systems. Topics covered are: solar heating with isothermal collectors; solid cooling with solid desiccant; liquid desiccant cooling systems; solar heating systems; solar water heaters; fields tests; and program management. 6 figs., 2 tabs. (FSD)

48473 (EUR–12110) **A passive solar heating facility for existing houses: Demonstration project: Final report.** Johnson, P. (Wimpey Labs. Ltd., Hayes (UK)). Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation; Wimpey Labs. Ltd., Hayes (UK). 1989. 41p. Sponsored by Commission of the European Communities. Contract SE/594/83-UK. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 5.

The project was to install the Barra passive solar system in five existing houses in various locations in the United Kingdom. This system utilizes thermosyphon air panels or solar chimneys and was developed by Professor Barra in Italy where it has been tested and exploited on new buildings. The objectives of this project were to optimize the system for UK conditions utilizing computer modeling and prediction techniques for retrofitting to existing houses, particularly of older stock. Detailed monitoring was to be carried out to measure the technical performance of the system and identify any modifications necessary for successful operation in the UK. The economic viability was to be determined to assess the market potential as an energy retrofit option. The project was carried out by Wimpey Laboratories which is a wholly owned subsidary of the George Wimpey PLC Group. Another Group member Company is Wimpey Homes Holdings which is currently the largest house-builder in the UK, completing on average 10,000–11,000 private houses each year. Thus although the main objectives of the project were concerned with retrofit application, the potential for new-build was to be evaluated in close association with a major volume house builder. 15 figs., 2 tabs.

1410 Solar Collectors and Concentrators

48474 (PB–90-250655/XAB) **Development of the Fresnel-lens-type solar collector.** Sawata, S. Electrotechnical Lab., Tsukuba, Ibaraki (Japan). ©1989. 12p. Source: NTIS, PC A10/MF A02).

Text in Japanese. Included in Bulletin of the Electrotechnical Laboratory, Vol. 53, No. 9, 61-71(1989).

Three types of specially designed concentrating solar collectors are constructed which use a combination of Fresnel lenses and flat mirrors. The Fresnel lens is made of acrylic resin. Two different type of lens are used: One is a linear Fresnel lens of 1.6 m long and 0.6 m wide, and the other of type is a circler Fresnel lens of 1.5 m in diameter. The total collection areas of the collectors are 1 sq m, 4 sq m, and 10 sq m respectively. The use of the flat mirror makes it possible to reduce the height and the volume of the collector and simplicity of the tracking mechanism. The experimental evaluation of the collector performance is made, and the result approximately agrees with the theoretical estimation.

1420 Heat Storage

48475 (PB-90-250663/XAB) **Latent thermal energy storage using form-stable high-density polyethylene.** Kamimoto, M.; Abe, Y.; Takahashi, Y.; Kanari, K.; Sakamoto, R. Electrotechnical Lab., Tsukuba, Ibaraki (Japan). ©1989. 9p. Source: NTIS, PC A10/MF A02.

Text in Japanese; Included in Bulletin of the Electrotechnical Laboratory, Vol. 53, No. 9, 119-126(1989).

A prototype latent thermal storage unit using form-stable high density polyethylene (HDPE) rods (the highest melting temperature is 135 deg C) has been developed. A direct contact heat transfer technique between HDPE rods and ethylene glycol (EG) is adopted. The direct heat transfer and a formation of a clear thermocline provide a good performance. Development of surface crosslinked HDPE, computer simulation on the performance of the storage units, and feasibility study on systems using the HDPE storage units, are also described.

15 GEOTHERMAL ENERGY

48476 (AFME-82-066-2) **Geothermics a 1982-1985 review.** Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France); Centre National de la Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matiernes Premieres (PIRSEM). 1987. 317p. (In French). (AFME-85-91-1002-2). Order Number DE91701156. Source: NTIS (US Sales Only), PC A14/MF A01.

The main themes of the geothermics research program (1982-1985) of the PIRSEM are: characterization of sedimentary and non-sedimentary basins (sedimentation, diagenesis, natural fracturing, porosity, permeability), study of the water natural circulation in the layers and outside stratification (speed and flow rate), evaluation of the maximal deepnesses and temperatures of the hydrothermal waters, study of the physico-chemical equilibrium of water and rocks, parameter affecting the temperature distribution, perturbation of the initial equilibrium by working.

48477 (AFME-84.2242) **Deep geology program in France, third research phase (1985-1986).** Feuga, B. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France); Bureau de Recherches Geologiques et Minieres (BRGM), 75 - Paris (France). Feb 1986. 472p. (In French). Order Number DE91701157. Source: NTIS (US Sales Only), PC A20/MF A01.

A deep geology and geothermal research site has been developed in the volcanic area of the center of France. Various well drill hole were realized in order to collect numerous data and information concerning petrography, petrology, microstructure and microtexture, geochemistry of the rocks and their degradation, thermal, electric and magnetic measurements, hydrogeology, fluid geochemistry.

1501 Resources and Availability

Refer also to citation(s) 48476

1502 Geology and Hydrology of Geothermal Systems

Refer also to citation(s) 48476, 48477

48478 (SAND-90-0325C) **A numerical study of convection in a layered porous medium heated from below.** Hickox, C.E.; Chu, Tze Yao. Sandia National Labs., Albuquerque, NM (USA). [1990]. 32p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901109-9: International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers, Dallas, TX (USA), 25-30 Nov 1990). Order Number DE90013837. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

As part of the Magma Energy Project being pursued at Sandia National Laboratories, a drilling program has been initiated within the Long Valley caldera near Mammoth Lakes, California. Seismological evidence obtained in this region suggests the presence of a relatively shallow magma body. We have performed a numerical simulation for a simplified model of the Long Valley geothermal system in order to elucidate the nature of the large-scale thermal structure within the system and to assess implications for the drilling program. The two-dimensional model consists of three horizontal layers, the upper two of which are porous and saturated with a single phase fluid. The system is limited in horizontal extent and heated uniformly from below. An associated planar, natural convective flow is thus produced. The results of our simulation indicate the possibility of wide variations in vertical temperature profiles for the model system, depending on the location of the drilling operation. Thus it can be inferred that, during the early stages of drilling, the vertical temperature distribution is not a reliable indicator of the presence or absence of a magma body at depth. 14 refs., 5 figs., 4 tabs.

1503 Geothermal Exploration and Exploration Technology

Refer also to citation(s) 48476, 48477

48479 (SAND-90-1696C) **Thermal neutron absorption cross sections for igneous rocks: Newberry Caldera, Oregon.** Lysne, P. Sandia National Labs., Albuquerque, NM (USA). [1990]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901101-13: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE90013399. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The thermal neutron absorption cross sections of geologic materials are of first-order importance to the interpretation of pulsed neutron porosity logs and of second-order importance to the interpretation of steady-state porosity logs using dual detectors. Even in the latter case, uncertainties in log response can be excessive whenever formations are encountered that possess absorption properties appreciably greater than the limestones used in most tool calibrations. These effects are of importance to logging operations directed at geothermal applications where formation vary from igneous to sedimentary and which may contain solution-deposited minerals with very large cross-section values. Most measurements of cross-section values for geologic materials have been made for hydrocarbon production applications. Hence, the specimen materials are sedimentary and clean in the sense that they are not altered by geothermal fluids. This investigation was undertaken to measure cross-section values from a sequence of igneous materials obtained from a single hole drilled in an active hydrothermal system. 3 refs., 1 fig.

1505 Economic, Industrial, and Business Aspects

Refer also to citation(s) 48780

1520 Geothermal Data and Theory

Refer also to citation(s) 48477, 48479

17 WIND ENERGY

1706 Wind Energy Engineering

Refer also to citation(s) 48755

48480 (AFME-84-1724-4) **Dynamic test of a 9m diameter wind turbine.** Bontemps, A. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France); Office National d'Etudes et de Recherches Aerospatiales (ONERA), 92 - Chatillon (France). Apr 1986. 27p. (In French). Order Number DE91701172. Source: NTIS (US Sales Only), PC A03/MF A01.

A modal identification of the rotating element of a wind turbine has been realized. Ten natural modes have been determined through an impulse excitation and a spectral analysis.

48481 (AFME-84-1724-6) **Putting into service the RFO wind turbine at the CNEEL.** Notin, C. Agence Francaise pour la

Maitrise de l'Energie, 75 - Paris (France); Office National d'Etudes et de Recherches Aerospatiales (ONERA), 92 - Chatillon (France). Feb 1986. 83p. (In French). Order Number DE91701170. Source: NTIS (US Sales Only), PC A05/MF A01.

The ONERA test results on a two-blade wind turbine to be connected to the power network are presented. The natural frequencies determination has involved a modification of the wind turbine structure. Blade mechanical strains are derived from the measured natural modes. The aerodynamical brake system is shown to be ineffective.

48482 (AFME–85-91-1003-1) **Software to estimate the energy production of wind turbine.** Beguin, D. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France); Centre Scientifique et Technique du Batiment, 75 - Paris (France). 1986. 79p. (In French). Order Number DE91701171. Source: NTIS (US Sales Only), PC A05/MF A01.

A software, based on a former small wind turbine setting Guide Book, is used to estimate the energy production of a wind turbine in a specific site. It takes into account the site description, the wind distribution, the wind turbine characteristics and it gives the energy production balance. The software is IBM-PC compatible.

48483 (SERI/TP–257-3795) **Performance and cost projections for advanced wind turbines.** Hock, S.M. (Solar Energy Research Inst., Golden, CO (USA)); Thresher, R.W.; Cohen, J.M. Solar Energy Research Inst., Golden, CO (USA). Aug 1990. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. (CONF-901109–11: International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers, Dallas, TX (USA), 25-30 Nov 1990). Order Number DE90000370. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper identifies two possible wind turbine system architectures that represent the next generation of horizontal-axis designs, targeted for the mid-1990's. Estimates of the effects of projected design refinements on energy capture and cost are used to calculate cost-of-energy (COE) estimates. Two basic design philosophies are presented: the first represents a system using power electronics to allow variable speed operation and the second represents an optimized stall-controlled rotor. Both concepts take advantage of recent technological innovations including advanced airfoils; innovative control strategies; drive-train improvements; and site-dependent system optimization strategies, such as tall towers for sites with strong vertical wind shears. Our investigation indicates that these design improvements will increase energy capture about 40% to 50% with a corresponding negligible impact on cost, when compared with current state-of-the-art wind systems. These performance improvements result in COE estimates ranging between $0.03 and $0.06/kWh for the mid-1990's for sites with annual average hub-height wind speeds from 8.5 mps to 6.8 mps. 19 refs., 3 figs., 3 tabs.

48484 (SERI/TP–257-3939) **Atmospheric performance of the special-purpose Solar Energy Research Institute (SERI) thin-airfoil family: Final results.** Tangler, J.; Smith, B.; Jager, D.; Olsen, T. Solar Energy Research Inst., Golden, CO (USA). Sep 1990. 5p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. (CONF-900989–1: European community wind energy conference and exhibition, Madrid (Spain), 10-14 Sep 1990). Order Number DE90000373. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Solar Energy Research Institute (SERI), in cooperation with SeaWest Energy Group, has completed extensive atmospheric testing of the special-purpose SERI thin-airfoil family during the 1990 wind season. The purpose of this test program was to experimentally verify the predicted performance characteristics of the thin-airfoil family on a geometrically optimized blade, and to compare it to original-equipment blades under atmospheric wind conditions. The tests were run on two identical Micon 65/13 horizontal-axis wind turbines installed side-by-side in a wind farm. The thin-airfoil family 7.96 m blades were installed on one turbine, and AeroStar 7.41 m blades were installed on the other. This paper presents final performance results of the side-by-side comparative field test for both clean and dirty blade conditions. 7 refs., 11 figs., 1 tab.

20 FOSSIL-FUELED POWER PLANTS

2001 Power Plants and Power Generation

Refer also to citation(s) 48104, 48117, 48118, 48119, 48120, 48501, 48602, 48688, 48755, 48890, 48891, 49178

48485 (CONF-900628–3) **Estimating the effect of generating unit age on EFOR [equivalent forced outage rate] and EAF [equivalent availability factor] for coal-fired steam units operating between 1964 and 1981.** Corio, M.R.; South, D.W.; Stokes, H.H. Argonne National Lab., IL (USA). [1990]. 7p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From 17. international conference for the electric power industry: reliability, availability, maintainability strategies for the 90's; Hershey, PA (USA); 12-15 Jun 1990. Order Number DE90017838. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper highlights results from phase 1 of a study conducted for the US Department of Energy, wherein we estimated the effect of age on various performance indices associated with the US population of coal-fired steam generating units. Techno-economic relationships between age and (1) equivalent forced outage rate (EFOR), (2) equivalent availability factor (EAF), and (3) heat rate were estimated with time series, cross-sectional econometric models for the period 1964–1981. The effect of age on EFOR and EAF were found to be significant. Although the effects vary by the operating and design characteristics of the unit, some general patterns can be seen. In the first 28 years of operation, it was determined that EFOR deteriorates by 8–9 percentage points due to age, without life extension/plant betterment programs. Improvement in EFOR after age 28 is attributable to a shift in duty cycle (baseload to cycling). The results of EAF with respect to age are similar to those found for EFOR. After an initial improvement, EAF deteriorates by 5–15 percentage points by age 18, depending on steam pressure. 2 figs., 1 tab.

48486 (CONF-9004133–6) **The TRW entrained combustor retrofit at Orange and Rockland Utilities, Lovett Station Unit 3.** Kettler, D.J. (Stone and Webster Engineering Corp., New York, NY (USA)); Mildener, M.; Manfred, R.K.; Norcross, W.R.; Ferrazara, S.F.; O'Sullivan, R. TRW, Inc., Redondo Beach, CA (USA). [1990]. 6p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC22-89PC88750. From American power conference; Chicago, IL (USA); 23-25 Apr 1990. Order Number DE90017873. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The entrained combustion technology is designed for new or existing utility and industrial applications. It is applicable for retrofit of coal-fired as well as oil-and gas-fired boilers. A major advantage of the combustor system is its ability to meet present and potential future sulfur dioxide (SO_2) emissions requirements without the need for a postcombustion SO_2 removal system. This paper discusses the design development of the CCT-I combustion system retrofit demonstration on O&R's Lovett Unit 3. Also addressed are the thermal integration of the combustor and the major plant modifications required based on the application of the combustor technology to the site-specific constraints. 6 refs., 9 figs.

48487 (CRIE-U–89030) **Control of microbiofouling using bacteriophage. 2.: Detection of phages and fundamental study of their lytic effect on fouling bacteria.** Sakaguchi, I.; Shinshima, K.; Kawaratani, K.; Sugai, O. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Nov 1989. 34p. (In Japanese). Order Number DE91701399. Source: NTIS (US Sales Only), PC A03/MF A01.

For control of microbiofouling of condenser tubes of thermal power plants, a method using bacteriophages has been receiving consideration. Detection of phages which perform bacteriolysis of fouling bacteria and the growth depression effect of phages to microbiofouling bacteria were examined. The detection and isolation of phages lysing the bacteria from seawater, were carried out. Eighteen strains of phages were isolated. The incidence of bacteriophages depended on the sort of bacteria, some of them were not detected at all, but some phages were found all through the year. A high frequency of phage incidence was observed with the cultures of rapid growing bacteria. But for cultures of slow growing

bacteria, phages were rarely isolated. In host bacteria, which is clear in the host range, and phage system, the growth depression effect of phages to microbiofouling bacteria was recognized. 29 refs., 16 figs., 6 tabs.

48488 (DGLR–89-01, pp. 585-593) **The application of state observers in structural dynamics.** Waller, H. (Bochum Univ. (Germany, F.R.)); Schmidt, R. Deutsche Gesellschaft fuer Luft- und Raumfahrt e.V., Bonn (Germany, F.R.). 1989. (CONF-8904374–: European forum on aeroelasticity and structural dynamics, Aachen (Germany, F.R.), 17-19 Apr 1989). In *European forum on aeroelasticity and structural dynamics 1989. Proceedings.* Source: Available from Deutsche Gesellschaft fuer Luft- und Raumfahrt e.V., Bonn (Germany, F.R.).

Mathematical models of technical constructions are favourably designed by the method of finite elements. They can be improved by methods of identification. By the use of these mathematical models, it is possible to design well-working state observers, which estimate the complete physical state of the system by using only measurements at few available points in combination with the mathematical model. In structural mechanics observers can be applied to monitor vibrations, to ascertain the maximal stress and to calculate the life of the system. They can also be used to supervise characteristical parameters of the structure like eigenfrequencies. The application of observers for large systems might cause problems. This is mainly due to the high number of degrees of freedom within the mathematical model. A solution is provided by 'modal observers', that are developed by using the method of modal analysis. These observers have turned out to be very efficient. Usually it is sufficient to observe only few lower eigenfrequencies. In this way even complicated structures can be observed in real time. An intelligent monitoring of machines or buildings becomes possible. The control of mechanical structures can be also simplified and improved by modal observers. (orig.).

48489 (DOE/MC/23077–2866) **Assessment of modular IGCC plants based on entrained flow coal gasification supplemental studies.** Fu, R.K. Foster Wheeler USA Corp., Clinton, NJ (USA). Oct 1989. 44p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-86MC23077. Order Number DE90009678. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In a previous study (1), Foster Wheeler made an assessment of modular IGCC power systems employing Texaco entrained flow gasification of Illinois No. 6 coal. In that study, five case studies were developed in order to compare the relative performance and economics of air vs. oxygen blown gasification and high temperature vs. low temperature gas cleanup. As a supplemental study, two additional IGCC design cases were developed as alternate to the original Case 2 and Case 3 configurations. The objective of the Case 2 alternate study was to assess the potential of zinc titanate in place of zinc ferrite. Compared to zinc ferrite, the zinc titanate system offered the following potential advantages: Does not require steam conditioning of the feed gas to avoid carbon formation; does not require reductive regeneration and the corresponding use of fuel gas; operates at higher temperature, about 1350°F; and has a longer projected sorbent life. The objective of the alternate Case 3 study was to determine the economic impact of producing sulfuric acid, instead of elemental sulfur, as the by-product from high temperature desulfurization using zinc ferrite. Sulfur recovery as by-product sulfuric acid therefore offered the potential for reducing both the capital and operating costs. 6 refs., 5 figs., 15 tabs.

48490 (DOE/MC/23270–2876) **Molten carbonate fuel cell power plant systems studies.** Johnson, W.H. International Fuel Cells Corp., South Windsor, CT (USA). Jun 1990. 73p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-87MC23270. Order Number DE90009697. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The goal of the DOE and IFC Molten Carbonate Fuel Cell (MCFC) Program is to develop a MCFC technology base capable of providing clean electrical energy at competitive cost when integrated with coal gasification systems. To be successful, a coal-fueled MCFC system must provide cost of electricity (COE) which is lower than that of current electric generation technologies and which is competitive with other long range electric generating systems. The strategy for the study was to initially evaluate the status of non-fuel cell systems to establish the basis for a competitive CG/MCFC power plant and the corresponding MCFC subsystem goals. Secondly, an iterative and comparative analysis of potential CG/MCFC systems was conducted. This analysis included a detailed examination of MCFC integration with gasifier technology in which the technical basis for MCFC compatibility with a broad range of gasifiers was established. Lastly, a detailed conceptual design was prepared for the most desirable CG/MCFC system. The design established the potential of the CG/MCFC power plant to meet the goals and provide a competitive cost of electricity at very high efficiency and significantly reduced emissions. The design also provided focus for the technical issues still outstanding and required for commercialization of the CG/MCFC technology. 27 figs., 23 tabs.

48491 (LBL–26455, pp. 181) **High-pressure phase equilibria in hydrocarbon-water (brine) systems.** Prausnitz, J.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Phase equilibria are required for design of efficient large-scale separation processes (e.g., distillation and extraction) in the chemical and related industries. In this context, efficient refers to optimum use of raw materials and to conservation of energy. Since the variety of technologically important fluid mixtures is extremely large, it is not possible to obtain all desired equilibria from experiment. Therefore, the objective of this research is the development of molecular thermodynamics for interpretation and correlation of limited, selected phase-equilibrium data toward reliable prediction of phase equilibria for computer-aided engineering design. The correlations are expressed through semitheoretical physicochemical models. In this research, particular attention is given to those systems that are of primary interest in energy-related industries, especially those concerned with fossil fuels, aqueous mixtures containing electrolytes, fossil-fuel/water mixtures, agricultural products, and mixtures encountered in biotechnology. Development of molecular thermodynamics calls for a combination of theoretical computations and experimental work. Further, it demands simultaneous awareness first, of progress in molecular science and second, of realistic requirements for engineering design.

48492 (LTKK-EN–B65) **Power generation using a low power Organic Rankine Cycle.** Lindgren, O. Lappeenrannan Teknillinen Korkeakoulu (Finland). Energiatekniikan Laitos. 1989. 81p. (In Finnish). Source: Lappenrannan Teknillinen Korkeakoulu, Finland, Energratekniikan Laitos.

The processes to convert heat to mechanical energy are primary based on water based power generation. In low temperatures it has been found that the Organic Rankine Cycle (ORC) is more efficient than the water based power generation process. The total efficiency of a circulation process depends on the efficiencies of each subprocess and this emphasizes the accurate design of them. In low power ORC process it is better to choose radial turbine type because of its high efficiency. The optimal speed of a turbine is inversely proportional to the square root of the power. This leads to the use of high rotating speeds. In the Lappeenranta University of Technology a low power ORC power plant has been developed. It utilizes a new technical solution based on high speed technology. The turbine, the generator and the feed pump have been coupled to the same axle. Due to the mechanical structure and the high rotating speed the power-weight ratio of the generator is low. This is of great importance when one wants to build a small scale and light weight power plant having a high power density. The small scale power plant can be connected to a low voltage network or it can function as a separate energy source having the produced electric energy stored in batteries. The high frequency alternating current produced by the generator is converted either to low frequency current by frequency converter or to direct current. An induction generator is generally used as the generator, although in special applications and in lower power range a permanent magnetgenerator can be used. An induction generator as well as a permanent magnet generator can be controlled by a voltage-source frequency converter which consists of an inverter, a DC filter, a line converter and a control unit. Technically the best solution would be a modular system consisting of these units. In that case the building of a variety of applications would also be simple.

48493 (MIC–90-03531/XAB) **Metallurgical investigation of main-steam-line weldment cracking, Lakeview TGS.** Westwood, H.J. Ontario Hydro, Toronto, ON (Canada). Research Div. ©1989. 48p. Source: NTIS, PC EE07/MF E01.

In early March, 1989, a steam leakage in the vicinity of the west main steam stop valve caused a shutdown of Unit 3 at Lakeview Thermal Generating Station. Insulation removal and inspection revealed a large through-wall circumferential crack adjacent to the weld between a T piece and the main steam stop valve. Similar, but less advanced damage was then disclosed in the east main steam line and also in both east and west lines of the identical Unit 4 at the same location. All these sections were removed and sent for metallurgical investigation, as were other suspect sections from these units and units 6 and 7. This report concerns the conventional destructive metallurgical investigation which was carried out on the removed sections from failed, damaged and suspect locations to characterize the damage mechanism in detail and to investigate the reasons for the damage.

48494 (OH/RD–89-232-K) **Metallurgical investigation of main steam line weldment cracking, Lakeview TGS [thermal generating station].** Westwood, H.J. Ontario Hydro, Toronto, ON (Canada). Research Div. 25 Oct 1989. 48p. (MICROLOG–90-03531). Source: PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

Failure of one weldment and cracking in three similar locations at an Ontario power plant was due to Type IV creep damage in the heat-affected zone on the casting side of welds between cast and forged components. Primary cause of failure was excess "system" stressing, most probably due to improper functioning of the piping support system. Although ignored in piping design, the effects of load redistribution due to creep under service conditions should be compensated by periodic inspection and adjustment of the support system, as required. Because of systematic differences and some deficiencies in chemical composition, the castings could be expected to exhibit both inferior creep strength and creep ductility compared with the forgings. Based on metallographic examination and on published information, it is believed that the Type IV damage probably initiated below the outside diameter surface. Developments in ultrasonic inspection techniques appear necessary in order to reliably detect the damage and to discriminate between real damage and innocuous weld metal defects. 12 refs., 31 figs., 2 tabs.

48495 (PB–90-255753/XAB) **Research and development of advanced gas turbine. Technical report.** National Aerospace Lab., Chofu, Tokyo (Japan). ©1989. 75p. (NAL-TR–1023). Source: NTIS, PC A04/MF A01.

Text in Japanese with English abstract.

The purpose of the program was to establish the technologies for the combined cycle power generation system, which has an overall thermal efficiency of 55% (LHV), by developing an advanced reheat-cycle gas turbine with low emissions. A wide variety of R & D programs had been conducted to realize the highly efficient advanced gas turbine, including development of heat resist materials, R & D of advanced technologies of gas turbine components, fabrication and operation of the advanced gas turbine, achievement and demonstration of environmental protection capabilities, and optimization of a total energy supply system. The National Aerospace Laboratory (NAL) had participated in this program since its commencement and had been in charge of R & D for advanced technologies of gas turbine components. The report describes the essential summary of these efforts at NAL.

48496 (PNL–7403) **Thermal energy storage for integrated gasification combined-cycle power plants.** Drost, M.K.; Antoniak, Z.I.; Brown, D.R.; Somasundaram, S. Pacific Northwest Lab., Richland, WA (USA). Jul 1990. 76p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. Order Number DE90016666. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

There are increasingly strong indications that the United States will face widespread electrical power generating capacity constraints in the 1990s; most regions of the country could experience capacity shortages by the year 2000. The demand for new generating capacity occurs at a time when there is increasing emphasis on environmental concerns. The integrated gasification combined-cycle (IGCC) power plant is an example of an advanced coal-fired technology that will soon be commercially available. The IGCC concept has proved to be efficient and cost-effective while meeting all current environmental regulations on emissions; however, the operating characteristics of the IGCC system have limited it to base load applications. The integration of thermal energy storage (TES) into an IGCC plant would allow it to meet cyclic loads while avoiding undesirable operating characteristics such as poor turndown capability, impaired part-load performance, and long startup times. In an IGCC plant with TES, a continuously operated gasifier supplies medium-Btu fuel gas to a continuously operated gas turbine. The thermal energy from the fuel gas coolers and the gas turbine exhaust is stored as sensible heat in molten nitrate salt; heat is extracted during peak demand periods to produce electric power in a Rankine steam power cycle. The study documented in this report was conducted by Pacific Northwest Laboratory (PNL) and consists of a review of the technical and economic feasibility of using TES in an IGCC power plant to produce intermediate and peak load power. The study was done for the US Department of Energy's (DOE) Office of Energy Storage and Distribution. 11 refs., 5 figs., 18 tabs.

48497 (PNL-SA–18353) **Electric utility benefits of superconducting magnetic energy storage.** De Steese, J.G.; Dagle, J.E. Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 29p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-9007169–1: Utility interest group meeting, Dallas, TX (USA), 10-11 Jul 1990). Order Number DE90017238. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper summarizes a preliminary scoping analysis to illustrate examples of the benefits electric utilities might derive from Superconducting Magnetic Energy Storage (SMES). A major objective of the study was to show that, even though SMES technology is at an early stage of development, available data permit the assessment of SMES benefits and costs in specific system applications. The purpose of this effort is to help increase utility interest in SMES and thereby assist the rapid development of the technology. A number of important benefits are addressed including the projected ability of SMES to provide: (1) cost-effective diurnal energy storage; (2) system stability and dynamic control; (3) an alternative to and/or deferral of new generation and transmission construction; (4) function enhancement of other system components; and (5) reduced reliance on premium fuels. While many of these SMES benefits have been evaluated in generic studies, this paper relates existing generic performance information to system-specific application scenarios. This study provides an early view of SMES benefits from several perspectives. At the national level, a major part of the SMES application potential may be projected from trends in utility storage capacity already evident abroad. On this basis, the SMES share among competing technologies in the US could provide a future alternative to between 15 GW and 45 GW of conventional generating capacity. The potential for SMES applications in the Pacific Northwest includes very small units (1 kWh/10 MW) to large 8000 MWh/1500 MW storage systems. Examples of other SMES applications considered were units that protect and enhance high-voltage direct-current (HVDC) transmission systems. 17 refs., 1 fig., 3 tabs.

48498 (WAU/CGS–CE03140, pp. 257-265) **Use of drainage wicks for an embankment on slickensided clay.** Kack, G.J. (Jacques Whitford Ltd., Ottawa, ON (Canada)); Harris, M.C.; Chatterji, P.K.; Trowsdale, D.R.; Thomas, R.R. Canadian Geotechnical Society, Waterloo, ON (Canada). 1989. (CONF-891015–: 42. Canadian geotechnical conference, Winnipeg (Canada), 23-25 Oct 1989; CE–03140). In *Materials: From theory to practice: Proceedings.* Source: Canadian Geotechnical Society, University of Waterloo, Waterloo, ON, CAN . Prices: PRICES UPON REQUEST.

The 650-hectare cooling pond for the Genesee Thermal Power Plant near Edmonton required more than 15 km of earth containment dyke up to 25 m high to be constructed on a high plastic clay foundation. The high portions of the cooling pond dyke were built in three stages between 1982 and 1986. An extensive instrumentation monitoring program was established to control the rate of fill placement during construction. Counter-balancing earth berms were used to stabilize cost of the high sections of dyke. During the later stages of dyke construction, lack of dissipation of high excess pore pressure in the foundation clay indicated that the sole use of counter-balancing berms might not provide sufficient stabilization. Prefabricated drainage wicks were used as an additional measure to lower the foundation pore pressures under the counter-balancing berms in these critical areas. Spacing of the wick drains was determined by applying Hansbo's wick drain theory and from data collected from a wick drain test section. Additional piezometers were installed prior to wick installation in order to assess the effectiveness of the wicks. Over 14,000 wick drains were installed at spacing of 2.5 to 2.75 m to a maximum depth of 26 m below the top of berm. The installation procedures are discussed, along with difficulties of installation. The wicks were very effective in lowering the foundation pore pressures and improving dyke stability. Instrument monitoring data used to assess the wick drain performance and to control the rate of construction during dyke completion is presented and discussed. 6 refs., 10 figs., 2 tabs.

2002 Waste Management

Refer also to citation(s) 48099, 48151, 48155, 48486, 49463, 49555

48499 (CONF-900801–32) **Strategies for utilizing ferrous*EDTA chelate as an additive in combined SO_2/NO_x aqueous scrubbing systems.** Medelsohn, M.H.; Harkness, J.B.L. Argonne National Lab., IL (USA). [1990]. 6p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From 25. intersociety energy conversion engineering conference; Reno, NV (USA); 12-17 Aug 1990. Order Number DE90017797. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Ferrous*EDTA chelate has been found to be an effective scrubbing agent for nitric oxide gas. A major problem encountered in its practical application is that that ferrous ion oxidizes in solution to the ferric species, thus decreasing the NO_x removal of the scrubbing solution. This paper discusses three strategies for overcoming this problem. Dow Chemical has studied the use of an electrolytic cell to reduce ferric ions to the corresponding ferrous species. Workers at the Pittsburgh Energy Technology Center have studied in situ bisulfite reduction of ferric ions to ferrous ions at elevated temperature (70°C). We have studied NO_x removal from simulated flue gas mixtures under various oxidizing conditions and have found that addition of an organic, polyphenolic compound to an aqueous scrubbing solution containing Fe(II)*EDTA leads to a sustained NO_x removal significantly higher than was found without the secondary additive. The improved performance of Fe(II)*EDTA under these conditions is attributed to the known capabilities of these organic compounds to both inhibit oxidation by dissolved oxygen and to rapidly reduce any ferric ions back to the original ferrous species. Advantages of a NO_x-control process based upon an additive in an SO_2-control chemistry over serial processes are discussed. 10 refs., 6 figs.

48500 (CONF-9007170–1) **Dry FGD [flue-gas desulfurization] at Argonne National Laboratory.** Livengood, C.D. Argonne National Lab., IL (USA). [1990]. 22p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From Current developments in control systems for SO_2 emissions; Washington, DC (USA); 17-18 Jul 1990. Order Number DE90017685. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Flue-gas desulfurization (FGD) systems based on spray drying are a relatively recent addition to the spectrum of sulfur dioxide (SO_2) control options available to utility and industrial boiler operators. Such systems appear to offer advantages over wet lime/limestone systems in a number of areas: low energy consumption, low capital cost, high reliability, and production of a dry waste that is easily handled and disposed of. These advantages have promoted rapid acceptance of dry scrubbers for applications using western low-sulfur coal, but uncertainties regarding the performance and economics of such systems for control of high-sulfur-coal emissions have slowed adoption of the technology in the Midwest and East. At Argonne National Laboratory (ANL) we have had more than eight years of operating experience with an industrial-scale dry scrubber used with a boiler firing high-sulfur (3.5%) midwestern coal. This paper describes our operating experience with that system and summarizes several research programs that have utilized it. 7 refs., 15 figs., 6 tabs.

48501 (DOE/FE–197P) **Comprehensive report to Congress, Clean Coal Technology Program: Full-scale demonstration of low-NOsub x cell burner retrofit.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Office of Clean Coal Technology. Jul 1990. 35p. Sponsored by U.S. DOE Fossil Energy. Order Number DE90018026. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This project describes the full-scale retrofit demonstration of Low-NO_x Cell (LNC) Burners proposed by the Babcock & Wilcox Company (B&W). The LNC burner was developed by B&W to provide a cost effective means to reduce NO_x emissions in boilers equipped with standard cell burners. The LNC burner is designed to provide an economical replacement for the standard cell burner, reduce NO_x emissions by 50%, and produce no impact on boiler operation and performance. In terms of the reduction of total acid emissions, the expected reduction in NO_x, on a tons removed basis, for the LNC burner technology results in the same environmental impact as an equivalent reduction in SO_2 emissions using another technology. The LNC burner fits in existing standard cell burner wall tube openings and therefore, does not require burner relocation or major boiler pressure part modifications. Retrofit materials generally consist of the LNC burner can be retrofitted to all utility boilers containing two-nozzle cell burners and could possibly be adapted to three-nozzle cell burner installations. 6 figs.

48502 (DOE/PC/79798–T7) **Limb demonstration project extension: Quarterly report No. 12, February, March, and April, 1990.** Babcock and Wilcox Co., Barberton, OH (USA). 15 Jun 1990. 23p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC22-87PC79798. Order Number DE90017878. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The DOE LIMB Demonstration Project Extension is a continuation of the EPA Limestone Injection Multistage Burner (LIMB) Demonstration. The EPA LIMB program was initiated in 1981. EPA ultimately expects to show that LIMB is a low cost control technology capable of producing moderate SO_x and NO_x control (50–60 percent) with applicability for retrofit to the major portion of the existing coal-fired boiler population. In Phase I – Design and Permitting, activities were limiting to updating drawings to as-built conditions. Phase II consists of a Coolside and LIMB Construction Start-Up and Shake-down. Task 3 activities included the procurement of the three (3) different coals and four (4) different sorbents for the LIMB Extension program. Task 3 activities included upgrading the lime feed system by replacing the rotary air lock with a Fuller-Kinyon pump. Start-Up was delayed until Ohio Edison Company completed their boiler tuning operation on their Network 90 control system. LIMB Extension Start-Up began on April 18, 1990. Phase III – Operation, Data Collection Reporting and Disposition, Task 2 activities were focused on the completion of Coolside testing on February 16, 1990. Under Task 3, LIMB Extension testing began April 27, 1990 on 3.2% sulfur coal. 3 figs.

48503 (DOE/PC/79855–T1) **Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 1, July 15, 1987–October 1, 1987.** Cook, W.J. (Helipump Corp., Cleveland, OH (USA)); Hossain, S.; Neyman, M.; Gordon, A.Z. Helipump Corp., Cleveland, OH (USA); IGR Enterprises, Beachwood, OH (USA). 18 Feb 1988. 19p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79855. Order Number DE90017290. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The IGR emission control technology controls SOx, NOx, and particulate emissions from coal combustion flue gases. It is based on a solid-state, flow-through, electrochemical reactor which reduces NO_x and SO_2 to nitrogen, sulfur, and oxygen cell. The cell

electrolyte is a solid-electrolyte, normally a high surface area ceramic oxide-ion conductor. Tasks this quarter include: Project Work Plan and Electrocatalyst Preparation and Screening Studies of electrocatalysts for high oxygen overpotential and low SO_2 and NO_x overpotential. Tests will be conducted with ceramic disks one inch in diameter. The reactor for disk testing has been built and the disks have been aquired. 4 refs., 9 figs.

48504 (DOE/PC/79855–T2) **Simultaneous particulates NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 2, October 1, 1987–December 31, 1987.** Cook, W.J. (Helipump Corp., Cleveland, OH (USA)); Hossain, M.S.; Neyman, M.; Gordon, A.Z. Helipump Corp., Cleveland, OH (USA); IGR Enterprises, Beachwood, OH (USA). 17 Mar 1988. 22p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79855. Order Number DE90017291. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The IGR emission control technology controls SOx, NOx, and particulate emissions from coal combustion flue gases. It is based on a solid-state, flow-through, electrochemical reactor which reduces NOx and SO_2 to nitrogen, sulfur, and oxygen. The cell electrolyte is a solid electrolyte, normally a high surface area ceramic oxide-ion conductor. Two tasks were active during this quarter, Task (1) Development of 10 Cubic Feet/Min High Surface Area Electrochemical Reactors and Task (2) Electrocatalyst Preparation and Screening Studies. Task (2) is the screening of electrocatalysts for high oxygen overpotential and low SO_2 and NO_x overpotential. Electrochemical measurements were made with oxide ion conducting ceramic disks in nitric oxide and sulfur dioxide gas mixtures. 1 ref., 9 figs.

48505 (DOE/PC/79855–T3) **Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 3, January 1, 1988–March 31, 1988.** Cook, W.J. (Helipump Corp., Cleveland, OH (USA)); Hossain, M.S.; Neyman, M.; Gordon, A.Z. Helipump Corp., Cleveland, OH (USA); IGR Enterprises, Beachwood, OH (USA). 20 Apr 1988. 22p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79855. Order Number DE90017292. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The IGR emission control technology controls SOx, NOx, and particulate emissions from coal combustion flue gases. It is based on a solid-state, flow-through, electrochemical reactor which reduces NOx and SO_2 to nitrogen, sulfur, and oxygen. The cell electrolyte is a solid electrolyte, normally a high surface area ceramic oxide-ion conductor. Three tasks were active during this quarter, Task (1) Development of 10 Cubic Feet/Min High Surface Area Electrochemical Reactors, Task (2) Procurement, Construction and Debugging of the Electrochemical Reactors and Particulate Removal System and Task (3) Electrocatalyst Preparation and Screening Studies. Task (3) is the screening of electrocatalysts for high oxygen overpotential and low SO_2 and NO_x overpotential. Electrochemical measurements were made with oxide ion conducting ceramic disks in nitric oxide and sulfur dioxide gas mixtures. 2 refs., 10 figs.

48506 (DOE/PC/79855–T4) **Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 4, April 1, 1988–June 30, 1988.** Cook, W.J. (Helipump Corp., Cleveland, OH (USA)); Hossain, M.S.; Neyman, M.; Gordon, A.Z. Helipump Corp., Cleveland, OH (USA); IGR Enterprises, Beachwood, OH (USA). 31 Aug 1988. 27p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79855. Order Number DE90017293. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The IGR emission control technology controls SOx, NOx, and particulate emissions from coal combustion flue gases. It is based on a solid-state, flow-through, electrochemical reactor which reduces NOx and SO_2 to nitrogen, sulfur, and oxygen. The cell electrolyte is a solid electrolyte, normally a high surface area ceramic oxide-ion conductor. Two tasks were active during this quarter: Task (1) Procurement, Construction and Debugging of the Electrochemical Reactors and Particulate Removal System and Task (2) Electrocatalyst Preparation and Screening Studies. In Task (1) a nine element particulate control apparatus has been constructed and ceramic oxygen ion conducting electrolyte reactor elements have been procured and coated with electrode materials on both the high surface area foam cathode and the flat low surface area anode sides. Task (2) is the screening of electrocatalysts for high oxygen overpotential and low SO_2 and NO_x overpotential. Electrochemical measurements were made with oxide ion conducting ceramic disks in gases containing NO_x and oxygen and ex-situ FT-IR was used to verify the electrochemical reduction rates. 1 refs., 10 figs., 6 tabs.

48507 (DOE/PC/79855–T5) **Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 5, July 1, 1988–September 30, 1988.** Cook, W.J. (Helipump Corp., Cleveland, OH (USA)); Hossain, M.S.; Neyman, M.; Gordon, A.Z. Helipump Corp., Cleveland, OH (USA); IGR Enterprises, Beachwood, OH (USA). 21 Nov 1988. 13p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79855. Order Number DE90017294. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The IGR emission control technology controls SOx, NOx, and particulate emissions from coal combustion flue gases. It is based on a solid-state, flow-through, electrochemical reactor which reduces NOx and SO_2 to nitrogen, sulfur, and oxygen. The cell electrolyte is a solid electrolyte, normally a high surface area ceramic oxide-ion conductor. Two tasks were active during this quarter: Task, Procurement, Construction and Debugging of the Electrochemical Reactors and Particulate Removal System and Task, Electrocatalyst Preparation and Screening Studies. In Task a nine element particulate control apparatus is ready for testing with oxide ion conducting pieces and a test apparatus has been setup to test ceramic oxygen ion conducting electrolyte reactor elements. Task is the screening of electrocatalysts for high oxygen overpotential and low SO_2 and NO_x overpotential. Electrochemical measurements were made with oxide ion conducting ceramic disks using a series of electrocatalysts in gases containing NO, SO_2 and oxygen. 1 ref., 3 tabs.

48508 (DOE/PC/79855–T6) **Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 6, October 1, 1988–December 31, 1988.** Cook, W.J. (Helipump Corp., Cleveland, OH (USA)); Hossain, M.S.; Keyvani, M.; Neyman, M.; Gordon, A.Z. Helipump Corp., Cleveland, OH (USA); IGR Enterprises, Beachwood, OH (USA). 14 Apr 1989. 20p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79855. Order Number DE90017345. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The IGR emission control technology controls SO_2/NO_x, and particulate emissions from coal combustion flue gases. The technology uses an electrochemical solid-state reactor which converts SO_2 and NO_X to S, N_2, and O_2. The cell electrolyte is a solid electrolyte, namely a high surface area ceramic oxide-ion conductor. Three tasks were active during this quarter: Task (1), Procurement, Construction and Debugging of the Electrochemical Reactors and Particulate Removal System, Tasks, (2) Reactor Operation on SO_2/NO_X Spiked Gas Streams, and Task (3) Electrocatalysts Preparation and Screening Studies. In Task (1) the particulate control apparatus has been completely installed and its operation is being examined with respect to filtration materials and solid electrolyte. In Task (2) electrochemical measurements were made with oxide ion conducting ceramic disks in gases containing NO and SO_2. In Task (3) the electrochemical measurements are being made using a series of electrocatalysts in gases containing NO, SO_2, and oxygen. 9 figs., 1 tab.

48509 (DOE/PC/79855–T7) **Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemcial technology: Technical progress report No. 7, January 1, 1989–March 31, 1989.** Cook, W.J. (Helipump Corp., Cleveland, OH (USA)); Keyvani, M.; Neyman, M.; Gordon, A.Z. Helipump Corp., Cleveland, OH (USA); IGR Enterprises, Beachwood, OH (USA). 22 May 1989. 16p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79855. Order Number DE90017346. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The IGR Process emission control technology controls SO_2/NO_x, and particulate emissions from coal combustion flue gases. The technology uses an electrochemical solid-state reactor which converts SO_2 and NO_x to S, N_2, and O_2. The cell electrolyte is a solid

electrolyte, namely a high surface area ceramic oxide-ion conductor. Tasks this quarter include: (1) Procurement, Construction and Debugging of the Electrochemical Reactors and Particulate Removal System; (2) Reactor Operation on SO_2/NO_x Spiked Gas Streams; and (3) Electrocatalysts Preparation and Screening Studies. In Task (1) the particulate control test apparatus has been completely installed and flyash tests have begun. During the tests a voltage is applied across the solid electrolyte and the current is monitored while flyash passes through the cell. In Task (1) electrochemical measurements were made with oxide ion conducting ceramic disks in gases containing NO and SO_2. In Task (3) the electrochemical measurements are being made using four electrocatalysts in gases containing NO, SO_2, and oxygen. 3 refs., 4 figs., 2 tabs.

48510 (DOE/PC/79855–T8) **Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 8, April 1, 1989–June 30, 1989.** Cook, W.J.; Cornell, L.P.; Keyvani, M.; Neyman, M. Helipump Corp., Cleveland, OH (USA). 21 Jul 1989. 25p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79855. Order Number DE90017347. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objective is to develop an all solid-state electrochemical technology to control SO_x, NO_x, and particulate emissions from coal combustion flue gases. It is based on a solid-state, electrochemical reactor which reduces NOx and SO_2 to nitrogen, sulfur, and oxygen. The solid electrolyte is a high surface area ceramic oxide-ion conductor such as a stabilized zirconia or ceria. The cell electrodes may be of various electronically conductive materials such as porous, high surface area nickel, silver, or gold. Work was performed in two areas, electrocatalyst preparation and testing and particulate control tests. Transition metal oxide electrocatalysts were tested by applying the electrocatalyst along with gold electrodes to a stabilized ceria solid electrolyte disk and measuring the reduction of NO and SO_2 in gas mixtures containing 0 to 4% oxygen while a voltage was applied to the disk. The high temperature particulate control test apparatus was installed and flyash tests were done. The efficiency of high temperature particulate filters was also tested. 2 refs., 10 figs.

48511 (DOE/PC/79855–T9) **Simultaneous particulates, NOx_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 9, July 1, 1989–September 30, 1989.** Cook, W.J.; Cornell, L.P.; Keyvani, M.; Neyman, M. Helipump Corp., Cleveland, OH (USA). 9 Nov 1989. 19p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79855. Order Number DE90017348. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objective is to develop an all solid-state electrochemical technology to control SOx, NOx, and particulate emissions from coal combustion flue gases. It is based on a solid-state, electrochemical reactor which reduces NOx and SO_2 to nitrogen, sulfur, and oxygen. Work was performed in the area of electrocatalyst preparation and testing. Transition metal oxides (Ru, Cr, V, W, Co, Mo), mixtures of transition metal oxides and transition metal oxide perovskites were tested as electrocatalysts. The electrocatalyst along with gold electrodes were coated and fired on a yittria stabilized ceria solid electrolyte disk. The reduction of NO and SO_2 in gas mixtures containing 0 to 4% oxygen was measured while a voltage was applied to the disk. 3 refs., 5 figs., 4 tabs.

48512 (DOE/PC/88889–T5) **Proof of concept testing of the advanced NOXSO flue gas cleanup process: Quarterly technical progress report, April 1–June 30, 1990.** Gilbert, R.L. MK-Ferguson Co., Cleveland, OH (USA). [1990]. 8p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-89PC88889. Order Number DE90016758. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This project is being performed by MK-Ferguson Company for the US Department of Energy Pittsburgh Energy Technology Center. The project is a pilot plant scale-up from laboratory testing of the NOXSO flue gas cleanup process. The process simultaneously removes both sulfur and nitrogen oxides from the flue gas. The objective of this project is to demonstrate the NOXSO Process can achieve the SO_2 and NO_x removal efficiencies under field conditions required for application to coal-fired utility boilers. The project is a scale-up of previous laboratory tests. It will be built at Ohio Edison's Toronto Station, a coal-fired power plant in Toronto, Ohio. The pilot plant will process a 12,000-SCFM slip stream of flue gas from the power plant. Preliminary plans of the project are described.

48513 (DOE/PC/89651–T1) **Innovative Clean Coal Technology (ICCT): 180 MW demonstration of advanced wall-fired combustion techniques for the reduction of nitrogen oxides (NOx) emissions from coal-fired boilers: Quarterly technical progress report, first quarter 1990.** Southern Co. Services, Inc., Birmingham, AL (USA). 30 May 1990. 10p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC22-90PC89651. Order Number DE90015424. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Objectives of this project are listed below: demonstrate in a logical stepwise fashion the short-term NO_x reduction capabilities of the following advanced low NO_x combustion technologies: (a) advanced overfire air (AOFA); (b) low NO_x burners (LNB); and (c) LNB with AOFA. Determine the dynamic long-term emissions characteristics of each of the combustion NO_x reduction methods tested using sophisticated statistical techniques. Evaluate the progressive cost effectiveness (i.e., dollars per ton NO_x removed) of the low NO_x combustion techniques tested. Determine the effects on other combustion parameters (e.g., CO production, carbon carryover, particulate characteristics) of applying the NO_x reduction methods listed above. Project preliminaries (planning, testing, data acquisition) are described. 2 figs.

48514 (EPRI-CS–3612-Vol.1-Rev.1) **Flue gas desulfurization (FGD) chemistry and analytical methods handbook: Volume 1, Process chemistry - Sampling, measurement, laboratory and process performance guidelines (Revision 1): Final report.** Noblett, J.G.; Burke, J.M. Electric Power Research Inst., Palo Alto, CA (USA); Radian Corp., Austin, TX (USA). ©Aug 1990. 333p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

The purpose of this handbook is to provide a comprehensive guide to sampling, analytical, and physical test methods essential to the operation, maintenance, and understanding of flue gas desulfurization (FGD) system chemistry. EPRI sponsored the first edition of this three-volume report in response to the needs of electric utility personnel responsible for establishing and operating commercial FGD analytical laboratories. The second, revised editions of Volumes 1 and 2 were prompted by the results of research into various non-standard aspects of FGD system chemistry. Volume 1 of the handbook explains FGD system chemistry in the detail necessary to understand how the processes operate and how process performance indicators can be used to optimize system operation. Volume 2 includes 63 physical-testing and chemical-analysis methods for reagents, slurries, and solids, and information on the applicability of individual methods to specific FGD systems. Volume 3 contains instructions for FGD solution chemistry computer program designated by EPRI as FGDLIQEQ. Executable on IBM-compatible personal computers, this program calculates the concentrations (activities) of chemical species (ions) in scrubber liquor and can calculate driving forces for important chemical reactions such as $S0_2$ absorption and calcium sulfite and sulfate precipitation. This program and selected chemical analyses will help an FGD system operator optimize system performance, prevent many potential process problems, and define solutions to existing problems. 22 refs., 17 figs., 28 tabs.

48515 (MIC–90-03278/XAB) **Electrical generating station proposal: Complete verbatim transcript.** Environmental Control Council, Halifax, NS (Canada). ©1990. 240p. Source: NTIS, PC EE17/MF E01.

Transcript of the public hearing on the proposed Point Aconi electrical generating station. The transcript includes reporting of the morning, afternoon and evening sessions, the presentation by N.S. Power Corp. at each session, questions to the presenters, presentations by intervenors and questions to the intervening presentors.

48516 (MIC–90-03529/XAB) **Atikokan TGS aquatic studies, 1981 to 1988, II: Water chemistry.** Haymes, G.T. Ontario Hydro,

Toronto, ON (Canada). Research Div. ©1989. 45p. Source: NTIS, PC EE07/MF E01.

Atikokan Thermal Generating Station consists of one 200 MW lignite-fired unit, with the condenser-cooling-water drawn from the 10-m depth of Moose Lake and discharged at the surface into Snow Lake. The discharge water circulates through Snow, Icy, Abie and Marmion Lakes before returning to Moose Lake. Pre- and postoperational aquatic studies were initiated in 1981 and were completed in 1988. This report presents chemical data collected during 1987 and 1988, integrates the chemical data from the entire study and evaluates the effects of the station on the water chemistry of the cooling circuit.

2004 Health and Safety

48517 (PB–90-253287/XAB) **Physical vulnerability of electric systems to natural disasters and sabotage.** Office of Technology Assessment (U.S. Congress), Washington, DC (USA). Jun 1990. 72p. (OTA-E–453). Source: NTIS, PC A04/MF A01.

Also available from Supt. of Docs.

The report evaluates the potential for long-term electric power outages following natural disasters and deliberate sabotage, analyzing how such disasters could happen and how the risk could be reduced. OTA examined the effects on an electric power system when various components are damaged and how the system can be restored. Present efforts and potential options to reduce vulnerability are described. Also, specific policy measures are analyzed and grouped according to whether they are likely to be implemented and their costs.

2005 Environmental Aspects

Refer also to citation(s) 49051, 49461

2006 Economic, Industrial, and Business Aspects

Refer also to citation(s) 48485, 48490, 48496, 48754, 49470

48518 (NSP–90-02603) **Nova Scotia Power Corporation. Sixty-ninth annual report, 1988/1989.** Nova Scotia Power Corp., Halifax, NS (Canada). 13 Jul 1989. 32p. (MICROLOG–90-02603). Source: PC Nova Scotia Power Corporation, Barrington Tower, Scotia Square, PO Box 910,, Halifax, NS, CAN B3J 2W5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

The Nova Scotia Power Corporation supplies electric power to over 380,000 customers in Nova Scotia. In 1989, over 8 million kWh of power was sold, 70-80% of which came from indigenous coal and hydroelectric sources, and the rest from oil-fired power stations. Other activities described in this report include a program to dispose of material contaminated by polychlorinated biphenyls, and a program to limit sulfur dioxide emissions to no greater than 160,000 tonnes/y by 1994. The latter program will rely on the use of circulating fluidized bed combustion in new coal-fired power stations being planned. Financial statements are also included. 3 figs., 1 tab.

21 NUCLEAR POWER PLANTS

Refer also to citation(s) 49689

48519 (IAEA-TC–560.03, pp. 13-27) **IAEA activities in computer aided safety analysis.** Almeida, C. (International Atomic Energy Agency, Vienna (Austria). Div. of Nuclear Safety). International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

This paper describes the present status of the IAEA activities in the field of computer-aided safety analysis. These activities aim to assist developing countries with a nuclear power plant programme to conduct the analysis necessary for design review and safety assessment, through the development of guidelines for these activities, the provision of the necessary tools (mostly computer codes) and the corresponding training, and also by providing an international forum for the exchange of information in the area of safety analysis. The paper also discusses future directions for the programme. (author). 10 refs, figs and tabs.

48520 (IWGRRPC–88-2) **Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components, Vienna, 18-20 October 1988: Summary report.** International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. 104p. (CONF-8810529–: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

The 9th regular meeting of the International Working Group on Reliability of Pressure Components took place from 18-20 October 1988 at the Agency's Headquarters. The meeting was attended by 25 representatives from 19 Member States and International Organizations. The agenda of the meeting included overviews of the national activities in the field of pressure retaining components of PWRs, review of the past IWGRRPC activities and updating of the working plan for years 1989-1992. A great deal of attention was paid to the involvement of the IWGRRPC in the Agency's programme on nuclear power plant ageing and life extension. Members of the IWGRRPC reviewed the long term plan of the activities and proposed a provisional list and scope of the IAEA Specialists' Meetings planned for the period 1989-1992. Seventeen papers were presented at the meeting. A separate abstract was prepared for each of these papers. Refs, figs and tabs.

48521 (IWGRRPC–88-2, pp. 17-32) **Overview of the recent results of the safety related research in pressure boundary components of Finnish nuclear power plants.** Toerronen, K. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Metallilaboratorio); Aaltonen, P.; Haenninen, H.; Kauppinen, P.; Keinaenen, H.; Rintamaa, R.; Wallin, K.; Valo, M. International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. (CONF-8810529–: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). In *Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components Vienna, 18-20 October 1988: Summary report.* Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

A brief overview of the Finnish programme concerning safety related research in pressure boundary components of nuclear power plants is presented. The focus in on recent results in the areas of fracture mechanics, large scale component tests, irradiation damage, environmental influence on materials as well as NDT. (author). 23 refs, 26 figs.

48522 (IWGRRPC–88-2, pp. 33) **Nuclear plant aging research in the United States.** Arlotto, G. (Nuclear Regulatory Commission, Washington, DC (USA)); Marston, T. International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. (CONF-8810529–: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). In *Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components Vienna, 18-20 October 1988: Summary report.* Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

USNRC, EPRI, and the Department of Energy have implemented aging research programs to address the technical issues related to potential degradation of the capability of components and structures to perform their intended functions after being placed in service. Aging, the net degradation in physical condition due to normal and abnormal environment and service, was explicitly or implicitly addressed in the design of all components, systems, and structures in U.S. nuclear power plants. Although aging has not compromised the safe operation of U.S. nuclear power plants throughout their accumulated operation of over 1000 plant-years,

the quest for improved availability and for safe plant operation during and beyond the current license period of 40 years has led to an increase in nuclear plant aging research over the past several years. This paper presents the aging research programs sponsored by the U.S. Nuclear Regulatory Commission (NRC) and by the U.S. utility industry through its research arm, the Electric Power Research Institute (EPRI). The research focuses on (1) increased understanding of aging mechanisms in a broad range of components, systems, and structures, and (2) more cost-effective ways of enhancing the management of aging via improved preventive and corrective maintenance (i.e., aging mitigation, inspection, surveillance, condition monitoring and refurbishment/replacement). The key aging-related technical issues are identified in the paper. Results of the research will be used by the NRC mainly to provide for timely and technically sound regulatory decisions regarding continued safe operation of nuclear plants of all stages of life. Utilities will use the results mainly to improve plant reliability in the short term and to realize the potential economic benefits of operating plants beyond their current licensed terms.

48523 (IWGRRPC--88-2, pp. 59-61) **Research activities in materials assessment, selection and development, fracture mechanics and non-destructive testing in Switzerland.** Njo, D.H. (Swiss Federal Nuclear Safety Inspectorate, Wuerenlingen (Switzerland)). International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. (CONF-8810529--: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). In *Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components Vienna, 18-20 October 1988: Summary report.* Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

Research activities in Switzerland relevant to reactor components are at present not coordinated to form a specific national programme. These research activities are being performed in the laboratories of the major industrial firms and in the universities and their institutes within the scope of their research programmes. The activities relevant to reactor components are mainly in the field of Materials Assessment, selection and development, fracture mechanics and nondestructive testing. Although most of the work was not carried out with materials for nuclear components, the basic results are of interest. Switzerland is also participating in internationally coordinated research programmes.

48524 (IWGRRPC--88-2, pp. 63-77) **Some ongoing R and D programs in the United States that relate to reactor pressure components.** Pugh, C.E. (Oak Ridge National Lab., Oak Ridge, TN (USA). Pressure Vessel Technology Section). International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. (CONF-8810529--: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). In *Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components Vienna, 18-20 October 1988: Summary report.* Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

The presentation of U.S. research programs at the last IWGRRPC meeting emphasized activities sponsored by the Electric Power Research Institute (EPRI) and by the utility industry. The remarks given this year will emphasize some of the work sponsored by the Nuclear Regulatory Commission (NRC). However, some brief comments are included relative to ongoing work sponsored by the EPRI and the Department of Energy. 4 refs.

48525 (IWGRRPC--88-2, pp. 37-38) **Research activities related to nuclear power plant ageing in the Federal Republic of Germany.** Foehl, J. (Stuttgart Univ. (Germany, F.R.). Staatliche Materialpruefungsanstalt). International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. (CONF-8810529--: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). In *Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components Vienna, 18-20 October 1988: Summary report.* Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

Published in summary form only. NUCLEAR POWER PLANTS/ reactor materials; REACTOR MATERIALS/aging; FEDERAL REPUBLIC OF GERMANY; AGING; RESEARCH PROGRAMS

2101 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled

Refer also to citation(s) 48221, 48248, 48370, 48570, 48587, 48592, 48643, 48647, 48654, 48656, 48663, 48668, 48670

48526 (CONF-901101--11) **Burnup credit feasibility for BWR spent fuel shipments.** Broadhead, B.L. Oak Ridge National Lab., TN (USA). [1990]. 5p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC05-84OR21400. From American Nuclear Society winter meeting; Washington, DC (USA); 11-15 Nov 1990. Order Number DE90012941. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Considerable interest in the allowance of reactivity credit for the exposure history of power reactor fuel currently exists. This "burnup credit" issue has the potential to greatly reduce risk and cost when applied to the design and certification of spent of fuel casks used for transportation and storage. Analyses[1] have shown the feasibility estimated the risk and economic incentives for allowing burnup credit in pressurized water reactor (PWR) spent fuel shipping cask applications. This paper summarizes the extension of the previous PWR feasibility assessments to boiling water reactor (BWR) fuel. As with the PWR analysis, the purpose was not verification of burnup credit (see ref. 2 for ongoing work in this area) but a reasonable assessment of the feasibility and potential gains from its use in BWR applications. This feasibility analysis aims to apply simple methods that adequately characterize the time-dependent isotopic compositions of typical BWR fuel. An initial analysis objective was to identify a simple and reliable method for characterizing BWR spent fuel. The method includes characterization of a typical pin-cell spectrum, using a one-dimensional (1-D) model of a BWR assembly. The calculated spectrum allows burnup-dependent few-group material constants to be generated. Point depletion methods were then used to obtain the time-varying characteristics of the fuel. These simple methods were validated, where practical, with multidimensional methods. 6 refs., 1 tab.

48527 (CONF-901101--12) **Calculation of BWR [Boiling Water Reactor] limit cycle amplitude using Galerkin's method.** Damiano, B. (Oak Ridge National Lab., TN (USA)); March-Leuba, J.; Euler, J.A. Oak Ridge National Lab., TN (USA). [1990]. 6p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From American Nuclear Society winter meeting; Washington, DC (USA); 11-15 Nov 1990. Order Number DE90012934. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper describes the application of Galerkin's method to estimate the amplitude of boiling water reactor (BWR) limit cycle oscillations. It will be shown that Galerkin's method can be applied to a model of BWR dynamics consisting of the point kinetics equations and the LAPUR generated feedback transfer function to calculate the time history of small amplitude limit cycles. This allows results from the linear frequency domain code LAPUR to be used to calculate nonlinear time domain information. 2 refs., 2 figs., 1 tab.

48528 (EPRI-NP--6927-D) **BWR [Boiling Water Reactor] Owners Group Intergranular Stress Corrosion Cracking Research Program: Executive summary: Phase 2 (1984--1988): Final report.** Bullen, D.B. (DG Engineering, Inc., Livermore, CA (USA)). Electric Power Research Inst., Palo Alto, CA (USA); DG Engineering, Inc., Livermore, CA (USA). ©Aug 1990. 115p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report is an Executive Summary of Phase II of the Boiling Water Reactor Owners Group Intergranular Stress Corrosion Cracking Research Program which was performed during the period 1984 through 1988. The objectives of this phase were to develop and deploy the technology required to detect and evaluate

recirculation piping system cracking due to IGSCC, extend BWR piping service lifetime, and facilitate expeditious recirculation piping system repair and replacement. This report presents the objectives, descriptions, results, and conclusions of the five major Phase II tasks: Nondestructive Examination, Testing of Interim Repairs and Remedies for Cracked Piping, BWR Water Chemistry, BWR Recirculation Piping System Replacement, and Decontamination and Passivation. 185 refs., 36 figs., 6 tabs.

48529 (EPRI-NP–6954) **Fabrication of axial stress corrosion cracks in Alloy 182 weld materials: Final report.** Walker, W.L. (General Electric Co., San Jose, CA (USA). Nuclear Energy Div.). Electric Power Research Inst., Palo Alto, CA (USA); General Electric Co., San Jose, CA (USA). Nuclear Energy Div. ©Sep 1990. 51p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

Demonstration specimens of dissimilar metal nickel-chromium-iron Alloy 182 weldments were prepared for ultrasonic examination. Defects included in the demonstration welds consisted of rectangular electrode discharge machined notches to determine the accuracy with which crack extensions could be determined, chemically cracked Alloy 182 implants to simulate actual service cracks and an irregular profile electrode discharge machined notch to evaluate the accuracy with which the true defect profile can be determined by ultrasonic examination. The final product of the program was a full size 711 mm (28 in.) diameter mockup of a reactor pressure vessel nozzle-to-recirculation pipe weld. The mockup contained both chemically cracked Alloy 182 implants and an irregular profile electrode discharge machined notch. 21 figs.

48530 (EPRI-NP–6956-D) **Hydrogen water chemistry fuel surveillance at Dresden-2.** Cheng, B. (General Electric Co., Pleasanton, CA (USA). Vallecitos Nuclear Center). Electric Power Research Inst., Palo Alto, CA (USA); General Electric Co., Pleasanton, CA (USA). Vallecitos Nuclear Center. ©Aug 1990. 127p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

The effects of hydrogen addition to the feedwater on the corrosion and hydriding of Zircaloy fuel components and the crud deposition characteristics on fuel rod surfaces have been under surveillance since the first implementation of hydrogen water chemistry (HWC) in BWRs at Dresden-2. The results to-date have shown that HWC has no adverse effects on fuel bundle performance or integrity. The crud deposits on fuel rods exposed to only HWC still exhibit orange-reddish color, and consist of mainly hematite, Fe_2O_3. Fuel rods exposed to three cycles of HWC showed equivalent or lower modular corrosion susceptibility than those exposed to only normal or combined normal/hydrogen water chemistry cycles. Moreover, rods exposed to only HWC had a stable uniform oxide of ≤ 5 μm thickness after three cycles. The growth rate of the oxide nodules was not altered by HWC, reaching 20–30 μm after three cycles. The modular corrosion susceptibility and oxide growth kinetics are, however, influenced by the cladding manufacturing process. Cladding fabricated from heat treated tubeshells had lower modular corrosion susceptibility than unheat treated cladding, with the oxide growth rate of the heat treated cladding (Type A) being reduced by 30–40%. Both hydrogen uptake and pickup fraction of the LTA rods exposed to only HWC are lower than that of the production rods exposed to NWC or combined NWC/HWC cycles. The results indicate that corrosion and hydriding performance may in fact have improved during cycles in which hydrogen was added at Dresden-2. Whether this is due to hydrogen or other factors has not been determined. 18 refs., 53 figs., 7 tabs.

48531 (EUR–12522, pp. 115-129) **Irradiation testing of SIEMENS/KWU LWR fuel in the HFR Petten.** Gaertner, M. (Siemens AG, Unternchmensbereich KWU, Erlangen, (DE)); Reichardt, K. Commission of the European Communities, Luxembourg (Luxembourg). 1989. (CONF-8904378–: HFR Colloquium, PETTEN (Netherlands), 20-21 Apr 1989). In *Prospects and future utilization.* Order Number DE91702056. Source: NTIS (US Sales Only), PC A18/MF A01.

The experimental data of SIEMENS/KWU on the performance of LWR fuel rods have been gathered to a large extent from irradiation tests carried out in the High Flux Reactor (HFR) Petten. As early as 1970, SIEMENS/KWU demonstrated the reliable load follow capability of a fresh PWR fuel rod in a power cycling test performed in the Pool-Side-Facility of the HFR in cooperation with JRC Petten.

48532 (EUR–12525) **Inherently safe characteristics of nuclear reactors.** Commission of the European Communities, Luxembourg (Luxembourg). 1989. 60p. Contract No ETFA-0008/D. Source: NTIS (US Sales Only), PC A04/MF A01.

This report is based on a detailed study which was carried out by Colenco (a company of the Motor-Columbus Group) on behalf of the Commission of the European Communities (CEC). It presents a summary of this study and concentrates more on the generic issues involved in the subject of inherent safety in nuclear power plants. It is assumed that the reader is reasonably familiar with the design outline of the systems included in the report. The report examines the role of inherent design features in achieving the safety of nuclear power plants as an alternative to the practice, which is largely followed in current reactors, of achieving safety by the addition of engineered safety features. The report examines current reactor systems to identify the extent to which their characteristics are either already inherently safe or, on the other hand, have inherent characteristics that require protective action to be taken. It then considers the advantages of introducing design changes to improve their inherent safety characteristics. Next, it looks at some new reactor types for which claims of inherent safety are made to see to what extent these claims are justified. The general question is then considered whether adoption of the inherently safe reactors would give advantages (by reducing risk in real terms or by improving the public acceptability of nuclear power) which are sufficient to offset the expected high costs and the technical risks associated with any new technology.

48533 (IAEA-TC–560.03, pp. 41-48) **The GRS thermalhydraulic system code ATHLET.** Austregesilo, H. (Gesellschaft fuer Reaktorsicherheit mbH (GRS), Garching (Germany, F.R.)); Miro, J.E.; Teschendorff, V. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The thermalhydraulic system code ATHLET is being developed by the Gesellschaft fuer Reaktorsicherheit (GRS) for the safety analysis of LWRs. The field of application comprises the whole spectrum of operational and abnormal transients, small and intermediate leaks as well as large breaks. An extended version (ATHLET-SA) that is being developed in cooperation with the Institut fuer Kernenergetik und Energiesysteme (IKE) at Stuttgart will allow the simulation of severe accidents with core degradation. A remarkable feature of ATHLET is the optional use of different fluid-dynamic models. Depending on the type of problem to be analyzed fast running or more detailed models can be selected from essentially the same input deck. Emphasis is given to a methodical assessment procedure which provides the basis for the quantification of code uncertainties. (author). 12 refs.

48534 (IAEA-TC–560.03, pp. 49-68) **ICARE, a computer code for severe fuel damage analysis - General description of the second version, ICARE2.** Chatelard, P. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Inst. de Protection et de Surete Nucleaire); Gonzalez, R.; Jacq, F.; Porrachia, A. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The computer code ICARE2 is under development at the Protection and Nuclear Safety Institute of Atomic Energy Commission (France). The aim of this analytical tool is to identify and analyze the main phenomena occurring during the severe disruption of LWR core. It allows the overall degradation computation sequences in both bundle and PWR cores: the first phase with intact geometry and the second phase characterized by loss of geometry due to

melt progression and relocation. However, in the present version, only a mixture of steam and hydrogen is available in the thermal-hydraulic model. This paper deals with a general description of the code design and physical models such as thermalhydraulics, thermics, chemical interactions, melt progression and relocation and fission products release. To illustrate the main capabilities of the code, some results of a demonstrative test on the Phebus design are shown. (author). 19 refs, figs, 3 tabs.

48535 (IWGRRPC–88-2, pp. 43-49) **Research programs for LWR pressure boundary components in Japan.** Miyazono, S. (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Structural Strength and Structure Lab.). International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. (CONF-8810529–: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). In *Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components Vienna, 18-20 October 1988: Summary report.* Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

This report describes the research activities on structural integrity and safety of LWR pressure boundary components conducted under the sponsorship with the Science and Technology Agency (STA) and Ministry of International Trade and Industry (MITI) in Japan. The following three main research programs are briefly summarized: (1) Verification test programs on integrity of stainless and carbon steel piping; (2) Research programs on pressurized thermal shock concern; (3) Research programs on plant life evaluation and extension. 6 figs, 5 tabs.

48536 (IWGRRPC–88-2, pp. 55-58) **R and D projects in reactor technology at the Swedish Plant Inspectorate (SA).** Dahlberg, L. (Swedish Plant Inspectorate, Stockholm (Sweden)); Brickstad, B. International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. (CONF-8810529–: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). In *Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components Vienna, 18-20 October 1988: Summary report.* Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

This presentation is a list of R and D projects descriptions in mechanics of materials and structures, non-destructive testing and materials and weld technology carried out by the Swedish Nuclear Inspectorate.

48537 (NUREG/CP–0112-Vol.1) **Proceedings of the third international Atomic Energy Agency specialist's meeting on subcritical crack growth: Opening session and Technical session 1.** Cullen, W.H. (ed.)— (Materials Engineering Associates, Inc., Lanham, MD (USA)). Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Materials Engineering Associates, Inc., Lanham, MD (USA); Argonne National Lab., IL (USA). Aug 1990. 307p. Sponsored by Nuclear Regulatory Commission. DOE Contract W-31109-ENG-38. (ANL–90/22-Vol.1;CONF-9005265–Vol.1: 3. International Atomic Energy Agency (IAEA) specialists' meeting on subcritical crack growth, Moscow (USSR), 14-17 May 1990). Source: NTIS, PC A14/MF A01 - GPO; OSTI; INIS.

This report is a compilation of papers which were presented at the Third IAEA Specialists' Meeting on Subcritical Crack Growth, held in Moscow, Russia on May 14–17, 1990. This document, Volume 1, contains the welcoming remarks and attendance records, as well as the contributed papers for Session 1, Corrosion Fatigue. Volume 2 contains the contributed papers for Sessions 2, 3 and 4, covering Stress-Corrosion Cracking, Test Methods, Models and Mechanisms, and summaries of National Programs in Argentina and the UK. Included as well are the Conclusions and Recommendations developed by the organizing committee of the meeting, and discussed and approved by the participants. Each individual paper has been cataloged separately.

48538 (NUREG/CP–0112-Vol.2) **Proceedings of the third international Atomic Energy Agency specialists' meeting on subcritical crack growth: Technical sessions 2, 3, and 4 and Recommendations and conclusions Session 5.** Cullen, W.H. (ed.)— (Materials Engineering Associates, Inc., Lanham, MD (USA)). Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Materials Engineering Associates, Inc., Lanham, MD (USA); Argonne National Lab., IL (USA). Aug 1990. 216p. Sponsored by Nuclear Regulatory Commission. DOE Contract W-31109-ENG-38. (ANL–90/22-Vol.2;CONF-9005265–Vol.2: 3. International Atomic Energy Agency (IAEA) specialists' meeting on subcritical crack growth, Moscow (USSR), 14-17 May 1990). Source: NTIS, PC A10/MF A01 - GPO; OSTI; INIS.

This report is a compilation of papers which were presented at the Third IAEA Specialists' Meeting on Subcritical Crack Growth, held in Moscow, Russia on May 14–17, 1990. Volume 1 contains the welcoming remarks and attendance records, as well as the contributed papers for Session 1, covering Corrosion Fatigue. This document, Volume 2, contains the contributed papers for Sessions 2, 3 and I4 covering Stress-Corrosion Cracking, Test Methods, Models and Mechanisms, and summaries of National Programs in Argentina and the UK. Included as well are the Conclusions and Recommendations developed by the organizing committee of the meeting, and discussed and approved by the participants. Each individual paper has been cataloged separately.

48539 (NUREG/CR–5640) **Overview and comparison of US commercial nuclear power plants: Nuclear power plant system sourcebook.** Lobner, P. (Science Applications International Corp., San Diego, CA (USA)); Donahoe, C.; Cavallin, C. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Technology; Science Applications International Corp., San Diego, CA (USA). Sep 1990. 597p. Sponsored by Nuclear Regulatory Commission. (SAIC–89/1541). Source: NTIS, PC A25/MF A01 - GPO; OSTI; INIS.

This report is the introductory volume to the Nuclear Power Plant Sourcebook Series and is intended as a source of current summary and comparative information on US commercial light water reactors (LWRs). The summary and comparative information is organized into the following four parts: (a) general US LWRs, (b) pressurized water reactors (PWRs), (c) boiling water reactors (BWRs), and (d) bibliographies of general PWR and BWR references, plant-specific references, system-specific references, and component-specific references. This report is supplemented by a set of Sourcebooks that provides more detailed information on specific US LWR plants.

2102 Power Reactors, Nonbreeding, Light-Water Moderated, Nonboiling Water Cooled

Refer also to citation(s) 48221, 48231, 48233, 48247, 48531, 48532, 48533, 48534, 48535, 48536, 48537, 48538, 48539, 48587, 48592, 48599, 48637, 48645, 48647, 48653, 48654, 48657, 48662, 48663, 48664, 48665, 48666, 48667, 48668, 48873, 48993

48540 (CEA-DAS–666) **Dispositions taken in France to limit gaseous releases from PWR power plants in abnormal operating conditions.** Collinet, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (FR). Dept. d'Analyse de Surete); Guieu, S.; Mulcey, P. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete. Dec 1989. 15p. (CONF-8910458–: IAEA advisory group meeting on handling and retention of airborne radionuclides at nuclear power plants during abnormal operations, Vienna (Austria), 16-20 Oct 1989). Order Number DE91702089. Source: NTIS (US Sales Only), PC A03/MF A01.

The implementation of France's major nuclear programme - 56 PWR units in service or under construction - has gone hand in hand with the development of an original philosophy in the field of nuclear safety. From an initial core of deterministic safety philosophy current in the seventies, which has been wholly retained and, in some instances, refined, a range of complements has been made to include consideration of a number of additional situations based on a probabilistic approach. This has resulted in a better coherence for safety and a reduction of the severe accident probability. Furthermore, the establishment of emergency plans has enabled the Safety Authorities and the utility to adopt a coherent and logical approach to severe accidents, with the aim of better

achieving defence in depth. This has resulted in the provision of certain additional measures intended to further reduce the consequences of severe accidents. In a accordance with the safety philosophy, adopted in France for nuclear PWR power stations, filtration systems have been specified and installed to limit the radiological consequences of consecutive gaseous emissions, on the one hand, in accidents taken into account in the design and, on the other hand, in accidents liable to jeopardize the integrity of the containment.

48541 (CEA-DAS–668) **Analysis of reactivity accidents in PWR'S.** Camous, F.; Chesnel, A. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete. Dec 1989. 18p. (CONF-8910457–: IAEA technical committee meeting on reactivity transients accidents, Vienna (Austria), 14-17 Oct 1989). Order Number DE91702077. Source: NTIS (US Sales Only), PC A03/MF A01.

This note describes the French strategy which has consisted, firstly, in examining all the accidents presented in the PWR unit safety reports in order to determine for each parameter the impact on accident consequences of varying the parameter considered, secondly in analyzing the provisions taken into account to restrict variation of this parameter to within an acceptable range and thirdly, in checking that the reliability of these provisions is compatible with the potential consequences of transgression of the authorized limits. Taking into consideration violations of technical operating specifications and/or non-observance of operating procedures, equipment failures, and partial or total unavailability of safety systems, these studies have shown that fuel mechanical strength limits can be reached but that the probability of occurrence of the corresponding events places them in the residual risk field and that it must, in fact, be remembered that there is a wide margin between the design basis accidents and accidents resulting in fuel destruction. However, during the coming year, we still have to analyze scenarios dealing with cumulated events or incidents leading to a reactivity accident. This program will be mainly concerned with the impact of the cases examined relating to dilution incidents under normal operating conditions or accident operating conditions.

48542 (CEA-DAS–669) **Nuclear safety in France.** Queniart, D. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete. Dec 1989. 17p. (CONF-891177–: International conference on pressurized water reactors: the PWR - the present and future of Europe's nuclear energy, London (UK), 6-7 Nov 1989). Order Number DE91702088. Source: NTIS (US Sales Only), PC A03/MF A01.

This paper outlines the organizational and technical aspects of nuclear safety in France. From the organization point of view, the roles of the operator, of the safety authority and of the Institute for Protection and Nuclear Safety are developed. From the technical viewpoint, the evolution of safety since the beginning of the French nuclear programme, the roles of deterministic and probabilistic methods and the severe accident policy (prevention and mitigation, venting containment) in France are explained.

48543 (CEA-DAS–672) **Safety problems related to the use of MOX assemblies in PWRS.** Gouffon, A.; Merle, J.P. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete. Dec 1989. 9p. (CONF-8911229–: IAEA specialist meeting on plutonium and uranium recycling, Cadarache (France), 13-16 Nov 1989). Order Number DE91700291. Source: NTIS (US Sales Only), PC A02/MF A01.

Curtailment of the LMFBR program along with the satisfactory performance of the La Hague reprocessing plant, with the consequent availability of large quantities of plutonium, provides Electricite de France (EDF) with the possibility of burning mixed uranium and plutonium oxide fuel (MOX fuel) in the core of certain PWR power plant reactors, hence reducing enriched uranium fuel requirements. Design provision has in fact been made for this possibility on sixteen 900 MWe plant units and is explicitly authorized in the relevant authorization decrees. In this paper, we have restricted our discussion to safety aspects pertaining to utilization of the fuel in the reactor. Generally speaking, the Safety Analysis Department has checked that the provisions made by EDF and/or the scheduled plant modifications enabled reactor unit operating safety to be maintained at the same level as for standard fuel management systems and that, in particular, the recycling of 30% MOX assemblies was compatible with observance, under accident conditions, of the same safety criteria as for all uranium cores.

48544 (EPRI-NP–6975-D) **The effect of dissolved zinc on the transport of corrosion products in PWRs: Final report.** Lister, D.H. (Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.); Godin, M.S. Electric Power Research Inst., Palo Alto, CA (USA); Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. ©Sep 1990. 65p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report describes an experimental program designed to evaluate the effects of dissolved zinc in the $\mu g/kg^{-1}$ range in PWR coolant on activity transport. The program consisted of two phases. The first measured corrosion product releases from Inconel-600 with and without zinc in the coolant, and monitored the corresponding growth of oxide films. The second measured the pick-up of Co-60 by type 304 stainless steel and Inconel-600 with and without zinc in the coolant, and again monitored the corresponding growth of oxide films. Zinc in the range 10–40 $\mu g/kg^{-1}$ lowered Co-60 pick-up by both materials by factors of 8–10, and generally led to thinner oxide films. A result showing that zinc led to a thicker film on Inconel, and a result that it had no significant effect on corrosion release from Inconel, were deemed to be anomalous. The mechanisms by which Co-60 pick-up was reduced by zinc were the inhibition of the growth of oxide films and the reduced incorporation of cobalt within the growing oxide. The latter dominated on stainless steel, and both were important on Inconel. A mathematical model of activation by Co-60 was adapted to the conditions of the experiment, and fitted to the data for stainless steel. Good fits to the data were obtained when logarithmic kinetics for film growth were assumed. 18 refs., 31 figs., 10 tabs.

48545 (ESTD-L–0108/R89) **Analysis of PWR auxiliary coolant: determination of chloride in borax/nitrite solution by known addition - known dilution potentiometry.** Midgley, D.; Gatford, C. National Power, Leatherhead (UK). Nov 1989. 27p. Order Number DE91602442. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Chloride concentrations of 75-250 $\mu g\ l^{-1}$ have been determined in simulated PWR auxiliary coolant containing 1000 mg l^{-1} each of sodium tetraborate and sodium nitrite. The effects of the two main components of the coolant solution on a variety of chloride-selective electrodes have been studied. Sodium tetraborate posed no problem except through its effect on the pH, which is easily adjusted. Such high concentrations of nitrite, however, caused significant deviations in e.m.f. for all the electrodes and marked tarnishing of the electroactive membrane after only one or two measurements. Sulphamic acid was selected as the best means of removing nitrite and silver chloride electrodes were preferred over mercury(I) chloride electrodes because of their greater robustness in the conditions. At these chloride concentrations, the electrodes are operating in their non-Nernstian response regions and direct potentiometry has poor precision, even if standards could be successfully matched to samples containing such high concentrations of background material. Known addition - known dilution potentiometry was adopted, with internal calibration for both slope factor and standard potential. (author).

48546 (IAEA-TC–560.03, pp. 28-34) **Experience of participants from the German Democratic Republic in DBA analysis for WWERs in the framework of the IAEA regional programme RER/9/004.** Hennig, D. (VEB Kombinat Kraftwerksanlagenbau, Berlin (German Democratic Republic)); Roeder, H.W.; Adam, E.; Hilse, H.; Horche, K. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

This paper reports on the experience of GDR participants on the IAEA activities related to safety analysis of WWER-type reactors.

Although GDR participates in the Regional Project RER/9/004 as an observer, calculations involving loss of coolant accident simulation have been performed with computer codes DYBLO-2 and RELAP4/MOD6. Some of the results of these calculations are discussed in the paper. (author). 7 refs, 11 pictures.

48547 (IAEA-TC–560.03, pp. 34-41) **Applications of safety analysis codes at the Institute of Atomic Energy, Beijing.** Yu Erjun (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy). International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The paper introduces the activities of the Institute of Atomic Energy (IAE) in safety analysis. In addition to a general introduction, the main results of analysis are presented, the coding and modeling problems are discussed and experiments for improving analysis codes are described. (author). Figs and 2 tabs.

48548 (IAEA-TC–560.03, pp. 79-97) **Comparison of PMK-NVH experimental results in the event of 7.4% cold and hot leg breaks.** Ezsoel, G. (Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics); Szabados, L. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

Analysis of postulated accidents in nuclear power plants are carried out by computer codes, which must be validated by experimental results. Experiments were carried out on the PMK-NVH facility, a scaled down model of the Paks Nuclear Power Plant equipped with WWER-440 reactors. This work presents the results of four experiments with cold and hot leg breaks modelling a 7.4% break in the plant starting from nominal operating conditions with and without hydroaccumulators in action and considering the availability of one high pressure system. A few results of the validation of RELAP4/MOD6 is also given in the report. (author). 7 refs and figs.

48549 (IAEA-TC–560.03, pp. 98-105) **Post-test calculation of SPE-2 with RELAP5/MOD2.** Petelin, S. (Institut Jozef Stefan, Ljubljana (Yugoslavia)); Parzer, I.; Gregoric, M.; Mavko, B.; Stritar, A.; Osredkar, M. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The PMK-NVH test facility was selected for the IAEA SPE-2 Standard Problem. This facility has a high pressure hydraulic loop containing electrically heated reactor core, steam generator, primary pump, high pressure safety injection system and low pressure safety injection accumulators. Small break loss of coolant accident was simulated. Results presented in this paper were obtained by post test calculation. Calculations were performed by RELAP5/MOD1/O25 IBM version and by RELAP5/MOD2/36.00 VAX version thermohydraulic computer codes using the same input model, rearranged only formally to fit slightly different input requirements for different program versions. (author). 6 refs, 8 figs.

48550 (IAEA-TC–560.03, pp. 105-113) **Post-test analysis of SPE-2 with TRAC-PF1.** Galetti, M.R.S. (Comissao Nacional de Energia Nuclear (CNEN), Rio de Janeiro, RJ (Brazil)); Madeira, A.A.; Borges, R.C.; Pontedeiro, A.C. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

This report describes the post-test calculations performed with the computer code TRAC-PF1, to model the PMK-NVH Second Standard Problem Exercise sponsored by the IAEA. The comparisons between measurements and calculations results are presented and analysed indicating the adequateness of using TRAC-PF1 code in small LOCA thermalhydraulic analysis. (author). 4 refs, 9 figs, 3 tabs.

48551 (IAEA-TC–560.03, pp. 113-120) **Thermohydraulic analysis for supporting PSA of SB LOCA in WWER-440.** Kulig, M. (Central Lab. for Radiological Protection, Warsaw (Poland)); Szczurek, J. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

This paper discusses the need for thermohydraulic analyses of WWER-type reactors in order to provide realistic evidence of accident sequence modelling. The majority of the analyses performed so far are dedicated to scenarios which do not lead to core damage. These are reviewed in the paper. Additional analyses, involving total unavailability of engineered safety features and secondary side feed and bleed are identified. The need for simplified models, in order to allow an increased number of cases analysed, is also discussed. (author). 7 refs, 1 tab.

48552 (IAEA-TC–560.03, pp. 121-127) **Emergency operating procedures for SGTR sequence.** Gregoric, M. (Institut Jozef Stefan, Ljubljana (Yugoslavia)); Petelin, S.; Mavko, B.; Parzer, I. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

Two steam generator tube rupture accidents combined with loss of all offsite power for NPP Krsko were analyzed to assess the impact of sequences of auxiliary feedwater system availability. Calculations were performed with RELAP5/MOD1/025 computer code. Results show that such a combined accident can be controlled with just half of safety systems available (design bases). Even if less than one half of safety systems are available (beyond design bases), the accident can be controlled by timely and correct operator actions. (author). 7 refs, 14 figs.

48553 (IAEA-TC–560.03, pp. 127-133) **Post-test analysis of natural circulation, flow coastdown, and pressurizer spray tests in a large four loop PWR using RELAP5/MOD2.** Brain, C.R. (Central Electricity Generating Board, Barnwood, Gloucester (UK). National Power (Nuclear) Div.). International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

This paper describes a series of calculations performed by CEGB in order to assess the RELAP5/MOD2 input dataset for the Sizewell-B nuclear power plant. Given the similarities of Sizewell-B with the Westinghouse SNUPPS Plants, results of commissioning tests from Callaway NPP and Wolf Creek were used in the validation process. Results presented demonstrate a good agreement between test data and calculations. (author). 3 refs, 5 figs.

48554 (IAEA-TC–560.03, pp. 133-140) **Safety of the advanced WWER-1000 in condition of failure of the emergency protection system.** Fil, N.S. (OKB 'Gidropress', Podol'sk (USSR)); Volkov, B.E.; Latyeva, L.A.; Aljekhin, G.V. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis,

Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

Analysis of the advanced WWER-1000 reactor design (WWER-88) taking into account improved safety system are presented. Calculations were performed with the computer code DYNAMIKA. Results are presented for the cases of reactor coolant pump disconnection, inadvertent injection into pressurizer, rupture of steam generator steam line coinciding with station blackout, and small loss of coolant accident. The results show that for these events the safety criteria stated in regulatory documents are met if the rapid Boron injection system is included in the WWER-88 design. (author). 14 figs.

48555 (IAEA-TC–560.03, pp. 148-152) **Analysis of bypass lines efficiency in WWER-440.** Balabanov, E. (Energoproekt, Sofia (Bulgaria)); Ivanova, A.; Sartmadjiev, A. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The investigation carried out and presented here is aimed at obtaining information on the efficiency of bypass lines installation between the lowest parts of the hot and cold legs loop seals. It is in correspondence with a proposal for the reconstruction of WWER-440 (V-230) units intended to improve their safety. The efficiency of bypass lines was tested under small LOCA conditions, the break with an equivalent diameter of 100 and 200 mm being situated on the delivery line of the main circulation pump. The results were compared against a reference case without bypass lines. The computation was carried out using the RELAP4/MOD6 computer code. (author). 6 figs, 1 tab.

48556 (IAEA-TC–560.03, pp. 153-168) **DOEL 4 - loss of external load transient: Simulation and analysis.** Stubbe, E.J. (Tractebel, Brussels (Belgium)); Vanhoenacker, L.; Moeyaert, P.; Schutter, P. de; Baeyens, R. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

An analysis is presented of a loss of external load transient, performed at the DOEL-4 plant during the commissioning period. The availability of a high quality data acquisition system, combined with a detailed numerical simulation of the transient by means of the RELAP-5 code did allow a detailed qualitative and quantitative analysis of the complex interacting plant phenomena. Both are indispensable in optimising the plant control systems to assure a smooth and stable transition from full load to house load without reactor trip. (author). 5 refs, 12 figs, 1 tab.

48557 (IAEA-TC–560.03, pp. 169-180). **Analysis of loop asymmetry in Paks nuclear power plant in the event of a cold leg break.** Toth, I. (Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics); Perneczky, L. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

This paper presents results of a 7.4% cold leg break calculation in a WWER-440 performed with RELAP4/MOD6 using a 3-loop nodalization scheme. The aim of the calculations was to evaluate the influence of the asymmetry among loops induced by HPSI flow in only one of the unbroken loops in the real plant. The results confirmed the different behaviour of each individual loop. However the fuel rod temperatures are almost unaffected by these differences. (author). 6 refs, 18 figs.

48558 (IAEA-TC–560.03, pp. 180-186) **Licensing analysis of steam generator tube plugging: Influence on LB-LOCA.** Stritar, A. (Institut Jozef Stefan, Ljubljana (Yugoslavia)); Mavko, B. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

Methodology for Large Break Loss of Coolant Accident was developed for an independent assessment of the accident. It is based on requirements of US conservative evaluation methodology. The main computer code used is RELAP4/MOD6. Three cases of different Steam Generator tubes plugging level were analysed. The compensation for the plugging was found in reduction of core peaking factor. (author). 5 refs, 5 figs, 3 tabs.

48559 (IAEA-TC–560.03, pp. 187-195) **Important conclusions from intermediate cold leg LOCA analysis of WWER 440 with RELAP4/MOD6 and SLAP.** Misak, J. (Vyskumny Ustav Jadrovych Elektrarni, Trnava (Czechoslovakia)); Bazso, Z.; Vaclav, E. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

Intermediate cold leg LOCA analyses performed with RELAP4/MOD6 and SLAP codes for WWER440/W213 reactor are summarized in the paper. The most important results of the calculations are presented in a form of conclusions and recommendations for further safety analysis. (author). 3 refs, 5 figs, 2 tabs.

48560 (IAEA-TC–560.03, pp. 195-204) **Siemens UB KWU-Code package for severe accidents.** Gast, P. (Siemens AG, Offenbach-am-Main (Germany, F.R.). Unternehmensbereich Kraftwerk Union). International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The Siemens UB KWU-Code package for severe accidents was developed to analyse all processes during the course of a severe accident with core melt that have an important influence on the source term. The main parts of the code system are the following: SCIMA (Siemens Code System for In-Vessel Core Meltdown Analysis) is a set of non mechanistic codes to analyse in-vessel core meltdown processes. The main purpose of these codes is to estimate the relevant time intervals from the beginning of the accident until RPV melt-through and to predict the mass and energy release rate into the containment. The fission product input to the containment is also calculated by SCIMA. WAVCO (Wasserstoff-Verteilung im Containment) is a multicompartment lumped parameter code to analyse the thermodynamics of hydrogen and other constituents within a subdivided containment following a design basis accident or severe accidents with meltdown scenarios. WECHSL is a mechanistic computer code developed to analyse the interaction of molten LWR-materials with concrete. It calculates the gas and energy rates from these processes to the containment (developed by KfK). NAUA is a computer code for calculating the aerosol behaviour and distribution in a containment. It was developed for applications in the field of fission product transport after core melt accidents. It describes only the aerosol behaviour. The containment thermodynamics and the source term for aerosols and steam are input for the code (developed by KfK). IMPAIR is a computer code for calculating the iodine behaviour and distribution including the chemistry in a containment (developed by KfK and PSI). These codes are not linked together but structured with respect to input

and output in order to facilitate source term analysis. (author). 6 figs.

48561 (IPEN-PUB--172) **Simplified model of a PWR primary circuit.** Souza, A.L.; Faya, A.J.G. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Jul 1988. 9p. (In Portuguese). Order Number DE91602463. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The computer program RENUR was developed to perform a very simplified simulation of a typical PWR primary circuit. The program has mathematical models for the thermal-hydraulics of the reactor core and the pressurizer, the rest of the circuit being treated as a single volume. Heat conduction in the fuel rod is analyzed by a nodal model. Average and hot channels are treated so that bulk response of the core and DNBR can be evaluated. A homogeneous model is employed in the pressurizer. Results are presented for a steady-state situation as well as for a loss of load transient. Agreement with the results of more elaborate computer codes is good with substantial reduction in computer costs. (author).

48562 (IWGRRPC--88-2, pp. 33-36) **Safety and reliability of reactor pressure components - Research activities in the German Democratic Republic.** Popp, K. (Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic)). International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. (CONF-8810529--: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). In *Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components Vienna, 18-20 October 1988: Summary report.* Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

In the German Democratic Republic only nuclear power plants with pressurized water reactors of the Soviet type WWER are in operation or under construction. The main research activities relevant to reactor components are co-ordinated by government programmes on nuclear energy. Several institutions and laboratories from the industry, the Academy of Sciences and universities are engaged in the research and development programmes, which are related to the activities of the International Working Group on Reliability of Reactor Pressure Components. Research and development programmes are also carried out on the basis of bilateral and multilateral agreements and contracts within the COMECON countries. (author).

48563 (IWGRRPC--88-2, pp. 40-42) **Reactor reliability research in Hungary in 1988.** Gillemot, F. (Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics). International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. (CONF-8810529--: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). In *Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components Vienna, 18-20 October 1988: Summary report.* Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

This report describes the activities of in-service inspection of NPP Paks. 8 refs.

48564 (IWGRRPC--88-2, pp. 50-53) **Activities in the field of nuclear power engineering in Poland.** Zdankiewicz, M. (Technical Design Office, Warsaw (Poland)). International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. (CONF-8810529--: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). In *Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components Vienna, 18-20 October 1988: Summary report.* Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

The nuclear power plant consisting of four 440 MW PWRs is now under construction at Zarnowiec. This plant is scheduled for commissioning in the 1990s. In the year 1987 decision was taken concerning the siting of the second nuclear power plant at Klempicz. This power plant is to operate four 1000 MW power units. Arrangements are now in course targeted toward the preparation of siting guidelines for the third Polish nuclear power plant. The guidelines are expected to appear still in this year.

48565 (IWGRRPC--88-2, pp. 62) **A review of the UK PWR structural integrity and materials programme.** Darlaston, B.J. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.); Gardner, W.E. International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. (CONF-8810529--: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). In *Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components Vienna, 18-20 October 1988: Summary report.* Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

Water Reactor related work has been pursued in the UK for many years, and this has resulted in the development of comprehensive facilities and expertise to undertake a wide range of R and D. A notable contribution to the light water reactor scene was what became known as the "Marshall Study Group Report on LWR Pressure Vessel Integrity". The application to build the first UK PWR at Sizewell led to a Public Inquiry which provided the opportunity to present the full range of world work and knowledge on structural integrity and materials issues. The deliberations of the Study Group and the papers required for the enquiry had a significant influence on the UK materials R and D programme. The many generic programmes previously pursued were modified to be more plant specific and provide essential back up to the design, safety and operation of Sizewell 'B'. The work in support of Sizewell 'B' is represented by well established programmes. The CEGB has in-house activities and the work within the UKAEA ranges from being fully supported by CEGB to fully supported by the Department of Energy. Although the work fully supported by CEGB is very plant specific there is an appreciable percentage of other work which is generic with a long term interest. Attention is now turning to work which may be required for Hinkley 'C' and other stations of the future. In this paper there is no attempt to cover all the topics in the programme. Those chosen are considered to be advancing scientific understanding as well as answering specific questions on plant. The facilities and expertise available are sufficient to tackle unforeseen operational problems as well as the wide range of topics deemed to be desirable in support of the design, construction and commissioning of the plant. The paper comprises the strategy and goals of the programme, a general review, comments on the forward programme and some technical highlights.

48566 (IWGRRPC--88-2, pp. 78) **Review of research activities in the area of reliability of reactor pressure components in Yugoslavia.** Najzer, M. (Institut Jozef Stefan, Ljubljana (Yugoslavia)). International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. (CONF-8810529--: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). In *Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components Vienna, 18-20 October 1988: Summary report.* Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

Published in summary form only. PRESSURE TUBES/reliability; PRESSURE TUBES/research programs; PRESSURE VESSELS/reliability; PRESSURE VESSELS/research programs; RELIABILITY; PWR TYPE REACTORS; YUGOSLAVIA

48567 (IWGRRPC--88-2, pp. 78) **Sensitivity analysis approach to P-T limits and pressurized thermal transient.** Glumac, B. (Institut Jozef Stefan, Ljubljana (Yugoslavia)); Najzer, M. International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. (CONF-8810529--: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). In *Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components Vienna, 18-20 October 1988: Summary*

report. Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

Reactor pressure vessel steel undergoes significant changes in brittle to ductile transition temperature shift ΔRT_{NDT} when irradiated with fast neutrons leaking from the PWR core. This means that, according to ASME III-G, permissible pressure-temperature relations have to be recalculated periodically to help prevent the non-ductile failure of the RPV during pressure-temperature transients. Heatup-cooldown limits calculations require intensive calculations of time dependent thermal and stress fields, RT_{NDT} determination, etc. and often with highly unreliable material properties data. The error induced by those unreliable data is then compensated for with introduction of additional safety factors. By the use of sensitivity analysis approach one can, performing only moderately complicated calculations, not only calculate certain quantities, but also their variance-covariance matrices, based upon known (either measured or modelled) covariance matrix of input parameters (i.e. material data). This contribution deals with an approach to first order sensitivity analysis of the time dependent temperature profiles calculation ($\{T_i(t)\}$ and $<\delta T_i(t)—\delta T_i(t)>$) in the core belt of the pressure vessel wall and also briefly outlines what has to be done to calculate the stress profiles and linear elastic fracture mechanics (LEFM) stress intensity factors together with their variance-covariance information, and, on the other hand, determine adjusted RT_{NDT} and reference stress intensity factor K_{IR} together with their variances $<\delta RT_{NDT}—\delta RT_{NDT}>$ and $<\delta K_{IR}—\delta K_{IR}>$. (author).

48568 (IWGRRPC–88-2, pp. 79-80) **Principal trends of investigation on substantiation of WWER vessel material serviceability.** Dragunov, Yu.G. (S.D.B. 'Hydropress', Podol'sk (USSR)). International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. (CONF-8810529–: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). In *Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components Vienna, 18-20 October 1988: Summary report.* Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

This publication gives a short description of research programs in the USSR on the problems of the WWER type reactor pressure vessels reliability and serviceability. The programs in the following areas have been covered: statistical approach to irradiation resistance characteristics; destructive testing of pressure vessel models; warm prestressing condition of vessel steels; vessel annealing: development of the method and actual annealing of reactor vessels of two units has been performed, results will be presented at the SMIRT Conference in 1989; surveillance program optimisation; experimental program; evaluation of test coupon 'cut out' from NVNPS unit 1 after 20 years of operation.

48569 (IWGRRPC–88-2, pp. 54-55) **The Spanish national program on the reliability of reactor pressure components.** Dequidt, E. (Instituto de Tecnologia Nuclear (CIEMAT), Madrid (Spain). Dept. de Materiales). International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. (CONF-8810529–: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). In *Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components Vienna, 18-20 October 1988: Summary report.* Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

Published in summary form only. PRESSURE VESSELS/ in-service inspection; PWR TYPE REACTORS; RESEARCH PROGRAMS; STRESS CORROSION

48570 (KURRI-TR–327, pp. 4-34) **Present status and subjects of research on heat removal in high conversion light water reactors.** Murao, Yoshio (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jan 1990. (In Japanese). (CONF-8901187–: Workshop on the cooling of high-performance reactors, Kumatori (Japan), 17-18 Jan 1989). In *Proceedings of the workshop on the cooling of high-performance reactors.* Order Number DE90777871. Source: NTIS (US Sales Only), PC A08/MF A01.

Merits of high conversion LWRs: (1) The utilization of nuclear fuel several times as much as that in LWRs is possible. The rate of effective utilization of uranium is 4-6%. (2) The active storage of plutonium is feasible. (3) The bridging to the nuclear fuel cycle industries in fast reactor age can be done. (4) These contribute to the control of plutonium storage as the partner of FBRs in fast reactor age. (5) These contribute to the flexibility of medium and long term energy strategy. The reduction of natural uranium demand by the introduction of high conversion LWRs: Assuming the scale of nuclear power facilities in 2030 as 107 million kW, and that HCLWRs are introduced from 2000, the reduction till 2100 is 13%. The features of high conversion LWRs, the effect of improving the conversion ratio by spectral hardening and so on are explained. The specification of high conversion LWRs is shown in comparison with other reactor types. The aim is the high conversion PWRs in which the same safety as conventional LWRs is ensured, and energy resources and economical efficiency are attractive. The schedule of the research and the subjects of the thermo-hydraulic engineering research are shown. (K.I.).

48571 (NUREG/CR–5554) **Recommendations for the shallow-crack fracture toughness testing task within the HSST [Heavy-Section Steel Technology] Program.** Theiss, T.J. (Oak Ridge National Lab., TN (USA)). Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Oak Ridge National Lab., TN (USA). Sep 1990. 37p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. (ORNL/TM–11509). Source: NTIS, PC A04/MF A01 - GPO; OSTI; INIS.

Recommendations for Heavy-Section Steel Technology Program's investigation into the influence of crack depth on the fracture toughness of a steel prototypic of those in a reactor pressure vessel are included in this report. The motivation for this investigation lies in the fact that probabilistic fracture mechanics evaluations show that shallow flaws play a dominant role in the likelihood of vessel failure, and shallow-flaw specimens have exhibited an elevated toughness compared with conventional deep-notch fracture toughness specimens. Accordingly, the actual margin of safety of vessels may be greater than that predicted using existing deep-notch fracture-toughness results. The primary goal of the shallow-crack project is to investigate the influence of crack depth on fracture toughness under conditions prototypic of a reactor vessel. A limited data base of fracture toughness values will be assembled using a beam specimen of prototypic reactor vessel material and with a depth of 100 mm (4 in.). This will permit comparison of fracture-toughness data from deep-cracked and shallow-crack specimens, and this will be done for several test temperatures. Fracture-toughness data will be expressed in terms of the stress-intensity factor and crack-tip-opening displacement. Results of this investigation are expected to improve the understanding of shallow-flaw behavior in pressure vessels, thereby providing more realistic information for application to the pressurized-thermal shock issues. 33 refs., 17 figs.

2103 Power Reactors, Nonbreeding, Graphite Moderated

Refer also to citation(s) 48532, 48538, 48613, 48634, 48638, 48652, 48882

48572 (EGG-M–90249) **Development of a detailed core flow analysis code for prismatic fuel reactors.** Bennett, R.G. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1990]. 15p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-901101–7: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE90013092. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The development of a computer code for the analysis of the detailed flow of helium in prismatic fuel reactors is reported. The code, called BYPASS, solves, a finite difference control volume formulation of the compressible, steady state fluid flow in highly cross-connected flow paths typical of the Modular High-Temperature Gas Cooled Reactor (MHTGR). The discretization of

the flow in a core region typically considers the main coolant flow paths, the bypass gap flow paths, and the crossflow connections between them. 16 refs., 5 figs.

48573 (GA-A-20115) **A review of reactor physics uncertainties and validation requirements for the modular high-temperature gas-cooled reactor.** Baxter, A.M.; Lane, R.K.; Hettergott, E.; Lefler, W. General Atomics, San Diego, CA (USA). May 1990. 18p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC03-89SF17885. (CONF-9005187-2: Specialists meeting on uncertainties in physics calculations for gas-cooled reactor cores, Villigen (Switzerland), 9-11 May 1990). Order Number DE90017588. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The important, safety-related, physics parameters for the low-enriched Modular High-Temperature Gas-Cooled Reactor (MHTGR) such as control rod worth, shutdown margins, temperature coefficients, and reactivity worths, are considered, and estimates are presented of the uncertainties in the calculated values of these parameters. The basis for the uncertainty estimates in several of the important calculated parameters is reviewed, including the available experimental data used in obtaining these estimates. Based on this review, the additional experimental data needed to complete the validation of the methods used to calculate these parameters is presented. The role of benchmark calculations in validating MHTGR reactor physics data is considered. 10 refs., 5 figs., 3 tabs.

48574 (IAEA-TC-560.03, pp. 68-74) **Large nuclear reactor transient simulation.** Ionov, A.I. (Institute of Research and Development, Moscow (USSR)); Panin, V.M.; Podlazov, L.N.; Rogova, V.D.; Sakharova, T.Yu.; Trekhov, B.E. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376--: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

Modern nuclear power reactors for nuclear power plants are large. This can create problems concerning power monitoring and control. This paper presents some calculations performed with the computer code TRIADA during the analysis of large RBMK-reactors. Basic modelling capability of the code is presented and code validation against experimental data is discussed. It should be noted that the TRIADA code has also been used for the analysis of the Chernobyl-4 accident. (author). 3 refs, 6 figs.

48575 (JAERI-M-90-071) **Development of THYDE-HTGR: computer code for transient thermal-hydraulics of high-temperature gas-cooled reactor.** Hirano, Masashi (Japan Atomic Energy Research Inst., Oarai, Ibaraki (Japan). Oarai Research Establishment); Hada, Kazuhiko. Japan Atomic Energy Research Inst., Tokyo (Japan). Apr 1990. 74p. Order Number DE90520223. Source: NTIS (US Sales Only), PC A04/MF A01.

The THYDE-HTGR code has been developed for transient thermal-hydraulic analyses of high-temperature gas-cooled reactors, based on the THYDE-W code. THYDE-W is a code developed at JAERI for the simulation of Light Water Reactor plant dynamics during various types of transients including loss-of-coolant accidents. THYDE-HTGR solves the conservation equations of mass, momentum and energy for compressible gas, or single-phase or two-phase flow. The major code modification from THYDE-W is to treat helium loops as well as water loops. In parallel to this, modification has been made for the neutron kinetics to be applicable to helium-cooled graphite-moderated reactors, for the heat transfer models to be applicable to various types of heat exchangers, and so forth. In order to assess the validity of the modifications, analyses of some of the experiments conducted at the High Temperature Test Loop of ERANS have been performed. In this report, the models applied in THYDE-HTGR are described focusing on the present modifications and the results from the assessment calculations are presented. (author).

48576 (JAERI-M-90-082) **A study on steam reforming process using nuclear heat of VHTR.** Takeda, Takeshi (Tokai Univ., Tokyo (Japan)); Tadokoro, Yoshihiro; Yasukawa, Shigeru. Japan Atomic Energy Research Inst., Tokyo (Japan). May 1990. 48p. (In Japanese). Order Number DE90520333. Source: NTIS (US Sales Only), PC A03/MF A01.

This report describes the simulation studies on steam reforming process using nuclear heat of Very High Temperature gas-cooled Reactor (VHTR) with the computer code HIGHTEX to investigate a possibility of steam reforming with rather lower temperature. The heat and mass balances of hydrogen production process through steam reforming and water gas shift reaction are studied for commercial scale production capacity 20000 Nm^3/hr. For obtaining a similar level of hydrogen production yield as attained in higher temperature operation both lowering process gas inlet pressure and highering steam to carbon ratio are necessary in lower temperature steam reforming reaction. Input nuclear heat per unit hydrogen production and plant thermal efficiency, for hydrogen production process which reheats raw material gases using the sampling steam from steam turbin, are evaluated to be 0.91 $Mcal/Nm^3$, 92.4 % respectively for the higher temperature case, while for the lower temperature case 0.92 $Mcal/Nm^3$, 92.0 %. (author).

48577 (LA-UR-90-1641) **A vectorized heat transfer model for solid reactor cores.** Rider, W.J.; Cappiello, M.W.; Liles, D.R. Los Alamos National Lab., NM (USA). [1990]. 36p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-36. (CONF-901101-2: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE90011973. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The new generation of nuclear reactors includes designs that are significantly different from light water reactors. Among these new reactor designs is the Modular High-Temperature Gas-Cooled Reactor (MHTGR). In addition, nuclear thermal rockets share a number of similarities with terrestrial HTGRs and would be amenable to similar types of analyses. In these reactors, the heat transfer in the solid core mass is of primary interest in design and safety assessment. One significant safety feature of these reactors is the capability to withstand a loss of pressure and forced cooling in the primary system and still maintain peak fuel temperatures below the safe threshold for retaining the fission products. To accurately assess the performance of gas-cooled reactors during these types of transients, a Helium/Hydrogen Cooled Reactor Analysis (HERA) computer code has been developed. HERA has the ability to model arbitrary geometries in three dimensions, which allows the user to easily analyze reactor cores constructed of prismatic graphite elements. The code accounts for heat generation in the fuel, control rods and other structures; conduction and radiation across gaps; convection to the coolant; and a variety of boundary conditions. The numerical solution scheme has been optimized for vector computers, making long transient analyses economical. Time integration is either explicit or implicit, which allows the use of the model to accurately calculate both short- or long-term transients with an efficient use of computer time. Both the basic spatial and temporal integration schemes have been benchmarked against analytical solutions. Also, HERA has been used to analyze a depressurized loss of forced cooling transient in a HTGR with a very detailed three-dimensional input model. The results compare favorably with other means of analysis and provide further validation of the models and methods. 18 refs., 11 figs.

48578 (ORNL/FTR-3725) **[High-temperature reactor materials for gas-cooled reactor]: Foreign trip report, August 24, 1990-September 1, 1990.** Haggag, F.M. Oak Ridge National Lab., TN (USA). 17 Sep 1990. 8p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90017730. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler participated in an information exchange under the US/FRG/Swiss Umbrella Agreement on high-temperature reactor materials for gas-cooled reactor development at Forschungszentrum Juelich GmbH (KFA), FRG, August 30-31, 1990. The traveler presented the US results of the first four irradiation capsules and discussed some of the radiation-induced damage mechanisms and compared our data to previously obtained German data (good comparison was noted). Dr. F. Schubert of KFA expressed interest in incorporating a set of miniature tensile specimens (to be machined by KFA from German pressure vessel steel intended for use in their HTGRs) in one of our future ORNL irradiation capsules. It was agreed that this is feasible. Incorporating the German

material in our program will increase our data base and knowledge of effects of irradiation on materials and particularly the influence and contribution of chemical composition and fabrication conditions on radiation embrittlement. The traveler also visited the KFA high-temperature reactor materials laboratory and was briefed on their activities. Prior to visiting KFA, the traveler presented a paper on small specimen techniques to measure radiation damage in pressure vessel steels at the Seventh ASTM-EURATOM Symposium on Reactor Dosimetry, Strasbourg, France, August 27–28, 1990. The paper was displayed in a poster session for two days, which gave the traveler the opportunity for several individual discussions and to exchange ideas with researchers from various countries.

2104 Power Reactors, Nonbreeding, Otherwise Moderated or Unmoderated

Refer also to citation(s) 48252, 48627, 48661, 50061

2105 Power Reactors, Breeding

Refer also to citation(s) 48224, 48611, 48616, 48633, 48635, 48640, 48641, 48650, 48872

48579 (CONF-901101–32) **Development of remote disassembly technology for liquid-metal reactor (LMR) fuel.** Bradley, E.C.; Evans, J.H.; Metz, C.F. III; Weil, B.S. Oak Ridge National Lab., TN (USA). [1990]. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. From American Nuclear Society winter meeting; Washington, DC (USA); 11-15 Nov 1990. Order Number DE90017745. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A major objective of the Consolidated Fuel Reprocessing Program (CFRP) is to develop equipment and demonstrate technology to reprocess fast breeder reactor fuel. Experimental work on fuel disassembly cutting methods began in the 1970s. High-power laser cutting was selected as the preferred cutting method for fuel disassembly. Remotely operated development equipment was designed, fabricated, installed, and tested at Oak Ridge National Laboratory (ORNL). Development testing included remote automatic operation, remote maintenance testing, and laser cutting process development. This paper summarizes the development work performed at ORNL on remote fuel disassembly. 2 refs., 1 fig.

48580 (CONF-901109–12) **Flaw assessment procedure for high temperature reactor components.** Ainsworth, R.A. (Nuclear Electric PLC, Berkeley (UK). Berkeley Nuclear Labs.); Ruggles, M.B.; Takahashi, Y. Oak Ridge National Lab., TN (USA). [1990]. 17p. Sponsored by Electric Power Research Institute. DOE Contract AC05-84OR21400. From International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers; Dallas, TX (USA); 25-30 Nov 1990. Order Number DE90015543. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

An interim high-temperature flaw assessment procedure is described. This is a result of a collaborative effort between Electric Power Research Institute in the USA, Central Research Institute of Electric Power Industry in Japan, and Nuclear Electric plc in the UK. The procedure addresses preexisting defects subject to creep-fatigue loading conditions. Laws employed to calculate the crack growth per cycle are defined in terms of fracture mechanics parameters and constants related to the component material. The crack growth laws may be integrated to calculate the remaining life of a component or to predict the amount of crack extension in a given period. Fatigue and creep crack growth per cycle are calculated separately, and the total crack extension is taken as the simple sum of the two contributions. An interaction between the two propagation modes is accounted for in the material properties in the separate calculations. In producing the procedure, limitations of the approach have been identified. Some of these limitations are to be addressed in an extension of the current collaborative program. 20 refs.

48581 (CONF-9009255–1) **SWAAM-code development and verification and application to steam generator designs.** Shin, Y.W.; Valentin, R.A. Argonne National Lab., IL (USA). [1990]. 11p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From IAEA working group on fast reactors, IWGFR specialists' meetings on steam generators; Aix-En-Provence (France); 26 Sep - 3 oct 1990. Order Number DE90017826. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper describes the family of SWAAM codes which were developed by Argonne National Laboratory to analyze the effects of sodium-water reactions on LMR steam generators. The SWAAM codes were developed as design tools for analyzing various phenomena related to steam generator leaks and the resulting thermal and hydraulic effects on the steam generator and the intermediate heat transport system (IHTS). The paper discusses the theoretical foundations and numerical treatments on which the codes are based, followed by a description of code capabilities and limitations, verification of the codes and applications to steam generator and IHTS designs. 25 refs., 14 figs.

48582 (IAEA-TC–560.03, pp. 205-208) **A suite of codes for the nuclear power plant design safety analysis.** Baranaev, Yu.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Viktorov, A.N.; Suvorov, A.P. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The system of computer codes used for safety analyses at the Institute of Physics and Power Engineering is described. The system, constructed around the codes RAPIRA, ROPAS and VIBROS can calculate the plant dynamics, radioactive transient and offsite consequences during a severe accident scenario. At present the codes are being used for plants under design, including combined heat and power generating plants. Studies for BN-800 liquid metal fast reactors were also carried out. (author). 1 fig.

48583 (JAERI-M–90-067) **Estimation of energy deposition in various test fuels in the NSRR FBR fuel tests.** Nakamura, Takehiko (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Fuketa, Toyoshi; Sobajima, Makoto; Hosoyamada, Ryuji. Japan Atomic Energy Research Inst., Tokyo (Japan). Apr 1990. 91p. (In Japanese). Order Number DE90520211. Source: NTIS (US Sales Only), PC A05/MF A01.

A Series of transient tests on Fast Breeder Reactor (FBR) fuel is being planned at Nuclear Safety Research Reactor (NSRR) in order to investigate FBR fuel behavior under accident conditions. The transient behavior of FBR fuel has been found quite different from those of LWR fuel, due to the difference in cladding materials and in chemical forms of fuel and coolant. Carbides, Nitrides and Metal fuels as well as Oxide fuels are considered for fuel in FBRs. Coolant is liquid sodium which is chemically active. Sodium loops and stagnant sodium capsules are being designed for the FBR fuel tests. These test rigs are quite different in structure from water capsules which are currently used for the NSRR test. Sodium loops and capsules will be operated at higher temperatures and will have neutron moderators and thermal insulators. Neutron transport calculations in the NSRR with these test rigs containing typical FBR fuel pins were performed. Energy depositions in the fuel with various pin sizes, Uranium 235 enrichment and plutonium enrichment effects are evaluated through the calculations. Test range of the NSRR FBR fuel tests were summarized quantitatively. Effects of structural materials and neutron moderator on energy depositions in the test fuel pins were also estimated to design test rigs effective in neutron economy. The results showed that a 'Monju' type mixed oxide fuel will be subjected to an energy deposition of up to 517 cal/g (2.16 kJ/g) in the NSRR FBR fuel tests. Polyethylene was found effective for neutron moderator as well as Zirconium Hydride. (author).

48584 (UJV–8605-R,T) **Experimental research of local hydrodynamic characteristics of fast reactor fuel assembly peripheral zone. 5: Results of measurement at group displacement. SPOGVY variants.** Hejna, J.; Mantlik, F.; Smid, J. Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia). Nov 1989.

100p. (In Russian). Order Number DE91602511. Source: NTIS (US Sales Only), PC A05/MF A01; OSTI; INIS.

For Part 4 see report UJV–7537-T (Feb 1986).

The results are presented of measurements of shear stress distribution and velocity fields on an aerodynamical model of a fast breeder reactor fuel subassembly periphery. The peripheral configuration is disturbed by two side rods displaced towards one rod of the second row. These three rods form a symmetrical cell with a relative pitch of 1.0325. A comparison is made of the results and results with nominal configuration. (author). 75 figs., 10 tabs., 13 refs.

48585 (UJV–8981-T) **Experimental research of local hydrodynamic characteristics of fast reactor fuel assembly peripheral zone. 6: Turbulent flow microstructure at a group displacement of the rods.** Hejna, J.; Mantlik, F.; Smid, J. Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia). Feb 1990. 106p. (In Russian). Order Number DE91602512. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

For Part 5 see report UJV–8605-R,T (Nov 1989).

The method and results are presented of an experimental investigation of the turbulent microstructure of the flow in a model of the fast breeder reactor fuel assembly periphery with bare rods. Peripheral geometry is disturbed by a displacement of two side rods towards one rod in the second row. (author).

48586 (UJV–8982-T) **Experimental research of local hydrodynamic characteristics of fast reactor fuel assembly peripheral zone. 7: Results of measurement in entry section of model.** Hejna, J.; Mantlik, F. Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia). Feb 1990. 35p. (In Russian). Order Number DE91602513. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

For Part 6 see report UJV–8981-T (Feb 1990).

The results of measurements of shear stress distribution on the wetted perimeters of the HEM-2 model rods with group displacement are presented for three distances from the inlet. The measurements of the time mean value and the fluctuation component of longitudinal velocity were made at one point of the cross section along the full length of the model. (author). 32 figs., 10 tabs., 6 refs.

2106 Power Reactors, Auxiliary, Mobile, Package, and Transportable

Refer also to citation(s) 48575

2107 Regulation and Licensing

Refer also to citation(s) 48615, 48848

48587 (IAEA-TC–560.03, pp. 75-78) **Verification of computer codes used in licensing.** Hoehn, J. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)); Rumpf, J. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

This paper discussed the difficulties encountered by a country trying to develop its own computer codes for safety analysis necessary for the licensing of nuclear power plants. Both reactor dynamics codes (DYN 3D and RAUDY-1000) and thermohydraulic codes are discussed and the main problems for their validation are identified. Suggestions are presented about the possible role of the IAEA in fostering exchange of information in this area. (author). 2 refs.

48588 (NUREG–0304-Vol.15-No.2) **Regulatory and technical reports (abstract index journal): Second quarter, April–June 1990.** Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services. Aug 1990. 44p. Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A03/MF A01 - GPO - OSTI.

This journal includes all formal reports in the NUREG series prepared by the NRC staff and contractors; proceedings of conferences and workshops; as well as international agreement reports. The entries in this compilation are indexed for access by title and abstract, secondary report number, personal author, subject, NRC organization for staff and international agreements, contractor, international organization, and licensed facility.

48589 (NUREG–0540-Vol.12-No.7) **Title List of Documents Made Publicly Available, July 1–31, 1990.** Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services. Sep 1990. 346p. Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A16/MF A01 - GPO; OSTI; INIS.

This monthly publication contains descriptions of the information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes docketed material associated with civilian nuclear power plants and other uses of radioactive materials and nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index. The docketed information contained in the Title List includes the information formerly issued through the Department of Energy publication Power Reactor Docket Information, last published in January 1979.

48590 (NUREG–0750-Vol.32-No.1) **Nuclear regulatory commission issuances.** Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services. Jul 1990. 59p. Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A04/MF A01 - GPO; OSTI; INIS.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

48591 (NUREG–0940-Vol.9-No.2) **Enforcement actions: Significant actions resolved: Quarterly progress report, April–June 1990.** Nuclear Regulatory Commission, Washington, DC (USA). Office of Enforcement. Sep 1990. 496p. Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A21/MF A01 - GPO - OSTI.

This compilation summarizes significant enforcement actions that have been resolved during one quarterly period (April–June 1990) and includes copies of letters, notices, and orders sent by the Nuclear Regulatory Commission to licensees with respect to these enforcement actions. It is anticipated that the information in this publication will be widely disseminated to managers and employees engaged in activities licensed by the NRC, so that actions can be taken to improve safety by avoiding future violations similar to those described in this publication.

48592 (NUREG/CR–2000-Vol.9-No.8) **Licensee Event Report (LER) compilation for month of August 1990: Volume 9, No. 8.** Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data; Oak Ridge National Lab., TN (USA). Sep 1990. 82p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. (ORNL/NSIC–200-Vol.9-No.8). Source: NTIS, PC A05/MF A01 - GPO; OSTI; INIS.

This monthly report contains Licensee Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during the one month period identified on the cover of the document. The LERs, from which this information is derived, are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power plant licensees in accordance with federal regulations. Procedures for LER reporting for revisions to those events occurring prior to 1984 are described in NRC Regulatory Guide 1.16 and NUREG-0161, Instructions for Preparation of Data Entry Sheets for Licensee Event Reports. For those events occurring on and after January 1, 1984, LERs are being submitted in accordance with the revised rule contained in Title 10 Part 50.73 of the Code of Federal Regulations (10 CFR 50.73 –

Licensee Event Report System) which was published in the Federal Register (Vol. 48, No. 144) on July 26, 1983. NUREG-1022, Licensee Event Report System – Description of Systems and Guidelines for Reporting, provides supporting guidance and information on the revised LER rule.

22 NUCLEAR REACTOR TECHNOLOGY

Refer also to citation(s) 49152

2201 Theory and Calculation

Refer also to citation(s) 48573, 48658, 49993

48593 (DOE/OR/00033–T440) **A nodal method for the solution of the static, few-group diffusion equations in hexagonal geometry.** Gehin, J.C. Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Nuclear Engineering. ©Feb 1990. 70p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-76OR00033. Source: Massachusetts Inst. of Tech., Cambridge, MA.

Many of the nodal methods that have been devised have been formulated only for reactor cores that have Cartesian geometry. Several reactors, such as LMFBR's, HTGR's and HWR's, however, have cores with hexagonal geometry. The objective of this research is to develop a nodal method which can be applied to these hexagonal cores. Beginning with the steady-state Boltzmann transport equation, formally exact few-group nodal equations are derived by the introduction of correction factors (called "discontinuity factor"). These equations have the same mathematical form as mesh-centered finite-difference equations and are shown to converge to the exact solution of the diffusion equation in the limit of very fine mesh spacing. The accuracy of the nodal method is determined for cell-sized and seven-hex, patch-sized nodes by the analysis of a benchmark problem. For the cell-sized nodes the method is shown to calculate the eigenvalue within 0.14% and the node-average power within 1.4%. The use of patch-sized nodes, however, results in limited accuracy in the analysis of the benchmark problem. This is attributed to the small size of the benchmark core. The results indicate that the hexagonal nodal method does have potential for accurate and efficient analysis of reactor cores.

48594 (FEI–1942) **To the problem of optimization of external and integral iteration algorithm in diffusion calculation of nuclear reactor.** Zemskov, E.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst. 1988. 20p. (In Russian). Order Number DE91602378. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The external and internal iteration algorithm used widely in diffusion programs of reactor calculation is analyzed by means of linear algebra. Conditions of optimal choice of the number of internal iterations performed at every external one are found for simplest cases. The results of the numerical experiment of calculation of a simulated reactor, which agree qualitatively with theoretical estimations are presented. 17 refs.; 5 figs.; 3 tabs.

48595 (IAE–4691-4) **TEMP-8 module. Calculation of reactor point kinetics with increased accuracy.** Sarbukov, V.V.; Mysenkov, A.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1988. 21p. (In Russian). Order Number DE91602379. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The TEMPS program realizing the procedure of solving the equations of reactor kinetics with a higher accuracy is described. The program has been performed for the ES and SM computers realizing the algorithmic language Basic, designed for operation in the dialog mode and has input - output service units. Provision is made for continuing the calculation of a problem with correction for the law of reactivity variation. The test comparison of the results obtained in the calculations using the TEMP8 program has been carried out for differennt versions of the law of reactivity variation including the calculations in the mode of calculation continuation. 3 refs.; 6 figs.; 8 tabs.

48596 (IAE–4797-4) **Analysis of inhomogeneities of reactor fuel assemblies using statistics criteria.** Nosov, V.I.; Kompaniets, G.V.; Petrushenko, R.P.; Krutov, A.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 21p. (In Russian). Order Number DE91602380. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

On the basis of the mathematical statistics methods conditions are formulated, that permit to show the boundaries of the region of technological deviations, within which observed inhomogeneities of fissile material in the fuel assemblies are of random character and their effect on the fuel assembly loadings can be considered insignificant. Using the Duncan and Abbe criteria it is possible to make verification of the hypothesis on absence of a systematic shift in uniform samplings of the experimental data. The efficiency of the approach developed is illustrated on example of a model problem.

48597 (ITEF–164-88) **TRECD program for three-dimensional calculation of a heterogeneous reactor in dipole approximation.** Malofeev, V.M.; Smirnov, S.E. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1988. 40p. (In Russian). Order Number DE91602381. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The TRECD program (FORTRAN, BESM-6 and ES computers) for a few-group two-and three-dimensional calculations of the reactor with the channels of a hight-multizone structure and located in the nodes of a square (TRECD version) or hexagonal (TREC6D version) lattice in the monopole and dipole approximations, is described. Difference transformation of the generalized Galanin-Feinberg equations combined with the decomposition of the axial component of the neutron flux in the Fourie series according to sinuses and the nonlinear iteration procedure to determine the effective coefficient of neutron multiplication are used for calculations. 7 refs.; 1 fig.

48598 (KURRI-TR–327, pp. 35-49) **Present status and subjects of research on safety design of medium and small size power reactors.** Ise, Takeharu (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jan 1990. (In Japanese). (CONF-8901187–: Workshop on the cooling of high-performance reactors, Kumatori (Japan), 17-18 Jan 1989). In *Proceedings of the workshop on the cooling of high-performance reactors.* Order Number DE90777871. Source: NTIS (US Sales Only), PC A08/MF A01.

In this report, the safety design particularly centering around heat removal of new medium and small size reactors which are developed in Europe and America and of which the concept of the reactors has preceded is described. Most of these reactors adopted the safety system having the function called passive safety. This safety function is based on simple physical laws such as the natural circulation, heat conduction, thermal expansion, gravity falling and so on of liquid and gas, and is applied to the shutdown of reactors at the time of accidents, the cooling of cores and containment vessels and so on. Further, in relation to the long term cooling after accidents, the concept of grace period is adopted. The PIUS (2010 MWt/622 MWe) proposed as an ultrasafe reactor by ABB-ATOM in Sweden, the ISER (645 MWt/210 MWe) and the SPWR (1100 MWt/350 MWe) in Japan, the AP-600 (600 MWe) of WH, the B-600 (1800 MWt/600 MWe) of B and W, the MAP (900 MWt/300 MWe) of CE, the SBWR (1800 MWt/600 MWe) of GE in USA, and the HSBWR (1800 MWt/600 MWe) and TOSBWR-900P (900 MWt/310 MWe) in Japan are described. As high temperature gas-cooled reactors, there are MRS, HTR-100 and HTR-500 of West Germany and MHTGR of USA. As FBRs, there are PRISM and SAFR of USA. As the small reactors for room heating, there are TPS of USA, SLOWPOKE of Canada and others. (K.I.).

48599 (UJV–8855-R) **Rod drop in the LR-0 reactor core comprising 55 fuel assemblies: A comparison of theoretical and experimental data.** Hadek, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)); Grundmann, U. Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia). Sep 1989. 24p. (In Russian). Order Number DE91602382. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Data from the third stage of kinetic measurements on the LR-0 reactor, performed in 1988, were employed for additional calculations using the 3-dimensional neutron kinetics code HEXDYN3D. The reactor consists of subassemblies similar to those in the WWER-1000 (PWR) reactor. The theoretical and experimental results are compared for the time behavior of the neutron flux caused by drop of the control rod cluster in various subassemblies of the reactor. The results demonstrate that the HEXDYN3D code is well suited to the treatment of the space-time behavior of the neutron flux. (author). 21 figs., 2 tabs., 16 refs.

2202 Components and Accessories

Refer also to citation(s) 48612, 48646, 48862

48600 (CONF-901178–1) **Irradiation creep of graphite.** Kennedy, C.R. Oak Ridge National Lab., TN (USA). [1990]. 4p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. From International symposium on carbon; Tsukuba (Japan); 4-8 Nov 1990. Order Number DE90015545. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Displacement damage of graphite by neutron irradiation causes graphite to change dimensions. This dimensional instability requires careful attention when graphite is used as as moderator and reflector material in nuclear devices. Natural gradients in flux and temperature result in time-varying differential growth generating stresses similar to thermal stresses with an ever increasing temperature gradient. Graphite, however, does have the ability to creep under irradiation, allowing the stress intensity to relax below the fracture strength of the material. Creep strain also serves to average the radiation-induced strains, thus contributing to the stability of the core. As the dimensional instability is a function of temperature, so are the creep characteristics of graphite, and it is of interest to generalize the available data for extension to more extreme conditions of fluence and temperature. Irradiation creep of graphite is characterized by two stages of creep; a primary stage that saturates with time and a secondary stage that is generally assumed to be linear and constant with time. Virtually all past studies have not considered primary creep in detail primarily because there is limited available data at the very low fluences required to saturate primary creep. It is the purpose of this study to carefully examine primary creep in detail over the irradiation temperature range of 150 to 1000°C. These studies also include the combined effects of creep, differential growth, and structural changes in graphite by irradiation. 3 refs., 5 figs.

48601 (EPRI-GS–6976) **International cooling-tower and spray pond symposium: Proceedings.** Electric Power Research Inst., Palo Alto, CA (USA). ©Sep 1990. 605p. Sponsored by Electric Power Research Institute. (CONF-9005267–: 7. international association for hydraulic research cooling tower and spraying pond symposium, Leningrad (USSR), 29 May - 2 jun 1990). Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

This document contains the manuscripts of sixty-one papers that were presented at the 7th Cooling Tower and Spray Pond Symposium of the International Association for Hydraulic Research, organized by the B.E. Vedeneev Institute (VNIIG) and held in Leningrad, USSR, in June 1990. This report represents a worldwide state-of-the-art survey of recent work on cooling towers and spray ponds. Individual papers are indexed separately on the energy database.

48602 (EPRI-NP–6516) **Guide for the application and use of valves in power plant systems: Final report.** Brooks, B.P. (ed.) (Brooks (B.P.), Los Gatos, CA (USA)); Fortier, R.E.; Kalsi, M.S. Electric Power Research Inst., Palo Alto, CA (USA); Stone and Webster Engineering Corp., Boston, MA (USA). ©Aug 1990. 669p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

The purpose of this guidebook is to present, in a comprehensive manner, information and methods that have been successfully applied in the application and use of valves in power plant systems to reliably achieve their intended function(s). The information is also directly applicable to comparable system applications other than in power plants. The book's primary audience is expected to include a range of people who establish the engineering specifications of the valves, install and operate the valves in various systems, and perform required maintenance and repair of the valves. A secondary audience is anticipated to include system designers, engineering students, and others for whom a more indepth knowledge of the capabilities and limitations of valves leads to an improved understanding of the requirements necessary for enhanced valve performance. 76 refs., 135 figs., 24 tabs.

48603 (IAE–4647-3) **Thermodynamics of steam-turbine cycle with minimum coolant flow rate.** Soldatov, V.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1988. 32p. (In Russian). Order Number DE91602383. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The problem of choosing the optimum parameters of a closed-cycle steam turbine plant from the viewpoint of ensuring the minimum flow rate of a cooling medium (a coolant) is studied. The conditions of attaining the minimum flow rate are compared with those of reaching the maximum cycle efficiency. More complex schemes are considered as well as the conventional Rankine cycle. In these schemes a working medium condences in step, which allows the specific flow rate of the coolant to be reduced about two times. The characteristics of the steam- and gas-turbine schemes of energy conversion are compared on the basis of the results obtained. 11 refs.; 17 figs.

48604 (IWGRRPC–88-2, pp. 9-10) **Report on the interregional training course on implication of radiation induced embrittlement for the integrity of pressure vessels.** Mondino, M. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. (CONF-8810529–: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). In *Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components Vienna, 18-20 October 1988: Summary report.* Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

Short communication. PRESSURE VESSELS/annealing; PRESSURE VESSELS/embrittlement; AGING; EDUCATION; IAEA; MEMBER STATES; POWER REACTORS; ANNEALING; EMBRITTLEMENT

48605 (IWGRRPC–88-2, pp. 39) **Investigation of materials from decommissioned reactor pressure vessel - a contribution to the understanding of irradiation embrittlement.** Kussmaul, K. (Stuttgart Univ. (Germany, F.R.). Staatliche Materialpruefungsanstalt); Foehl, J.; Weissenberg, T. International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. (CONF-8810529–: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). In *Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components Vienna, 18-20 October 1988: Summary report.* Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

For the first time material samples from the reactor pressure vessel of a decommissioned nuclear power plant (Gundremmingen unit A, Federal Republic of Germany, FRG) were trepanned and investigated in the FRG within an international cooperative program to establish material toughness data in comparison with those from the surveillance program and the initial material state. The materials under consideration are base material from several vessel shells, circumferential weld and heat affected zone including acceptance data, irradiated state and thermally aged only condition. The fluence of the vessel wall is in the range of $3\text{-}4\cdot10^{18}cm^{-2}$. The material response to neutron radiation is compared with the Code trend curves. For the material of one vessel shell severe degradation (upper shelf drop down to 55 J) was found in transverse direction which is not in accordance with the existing trend curves. This fact was not recognized from the surveillance program since according to the practice in the past specimens of this type were not included. Annealing of those specimens did not provide the expected recovery. The behavior of a second vessel shell and

the weld material could conservatively be predicted by the Code. From the available data it must be concluded that the high degradation of the one vessel shell is typical for only this specific material and cannot be attributed to the in-service parameters of the reactor. Irradiation experiments of archive material in test reactors, however, did not indicate this severe susceptibility to neutron radiation. (author).

48606 (IWGRRPC–88-2, pp. 81-91) **PISC III: Third programme for the inspection of steel components.** Herkenrath, H. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. (CONF-8810529–: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). In *Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components Vienna, 18-20 October 1988: Summary report.* Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

For some years, the question had been asked whether the ultrasonic Non Destructive Examination (NDE) techniques used on heavy steel sections were sufficiently effective and reliable to satisfy the requirements for integrity assessment on important structures such as pressure vessels. The early answers often involved optimistic opinions and the only facts arose from inconclusive limited trials. Occasionally it became known that some large defects had indeed not been detected but there was little public discussion or explanation of such failures. On the other hand, there were claims that unreliable NDE often led to unnecessary and costly repairs. A series of major co-operative programmes known collectively as PISC (Programme for the Inspection of Steel Components) has been progressively developed so as to provide as complete an answer as possible to these questions on the capability of NDE. 2 refs, 12 figs, 1 tab.

48607 (IWGRRPC–88-2, pp. 11-16) **Main current development programs in Belgium.** Berthe, J. (Bureau d'Etudes Tractebel, Brussels (Belgium). Dept. Mecanique). International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components. Apr 1990. (CONF-8810529–: 9. regular meeting of the international working group on reliability of reactor pressure components, Vienna (Austria), 18-20 Oct 1988). In *Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components Vienna, 18-20 October 1988: Summary report.* Order Number DE91602421. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

Short note. PRESSURE VESSELS/fatigue; PRESSURE VESSELS/in-service inspection; STEAM GENERATORS/fatigue; STEAM GENERATORS/in-service inspection; BELGIUM; POWER REACTORS; FATIGUE; RESEARCH PROGRAMS

48608 (NUREG/CR–5451) **Crack-arrest behavior in SEN wide plates of low-upper-shelf base metal tested under non-isothermal conditions: WP-2 series.** Naus, D.J. (Oak Ridge National Lab., TN (USA)); Keeney-Walker, J.; Bass, B.R.; Robinson, G.C. Jr.; Iskander, S.K.; Alexander, D.J.; Fields, R.J.; deWit, R.; Low, S.R.; Schwartz, C.W.; Johansson, I.B. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Oak Ridge National Lab., TN (USA). Aug 1990. 265p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. (ORNL–6584). Source: NTIS, PC A13/MF A01 - GPO; OSTI; INIS.

The Heavy-Section Steel Technology (HSST) Program at the Oak Ridge National Laboratory under the sponsorship of the Nuclear Regulatory Commission is conducting analytical and experimental studies aimed at understanding the circumstances that would initiate the growth of an existing crack in a reactor pressure vessel (RPV) and the conditions leading to arrest of a propagating crack. Objectives of these studies are to determine (1) if the material will exhibit crack-arrest behavior when the driving force on a crack exceeds the ASME limit, (2) the relationship between K_{Ia} and temperature, and (3) the interaction of fracture modes (arrest, stable crack growth, unstable crack growth, and tensile instability) when arrest occurs at high temperatures. In meeting these objectives, crack-arrest data are being developed over an expanded temperature range through tests involving large thermally shocked cylinders, pressurized thermally shocked vessels, and wide-plate specimens. The wide-plate specimens provide the opportunity for a significant number of data points to be obtained at relatively affordable costs. These tests are designed to provide fracture-toughness measurements approaching or above the onset of the Charpy upper-shelf regime in a rising toughness region and with an increasing driving force. This document discusses test methodology and results. 23 refs., 92 figs., 25 tabs.

2203 Fuel Elements

Refer also to citation(s) 48620, 48630

48609 (CONF-9009108–1) **The ORR Whole-Core LEU Fuel Demonstration: Final report.** Bretscher, M.M.; Snelgrove, J.L. Argonne National Lab., IL (USA). [1990]. 33p. Sponsored by U.S. Department of Defense; U.S. DOE Management & Administration. DOE Contract W-31109-ENG-38. From International meeting on reduced enrichment for research and test reactors; Newport, RI (USA); 23-27 Sep 1990. Order Number DE90017817. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The ORR Whole-Core LEU Fuel Demonstration, conducted as part of the US Reduced Enrichment Research and Test Reactor Program, has been successfully completed. Using commercially-fabricated U_3Si_2-Al 20%-enriched fuel elements (4.8 g U/cc) and fuel followers (3.5 g U/cc), the 30-MW Oak Ridge Research Reactor was safely converted from an all-HEU core, through a series of HEU/LEU mixed transition cores, to an all-LEU core. There were no fuel element failures and average discharge burnups were measured to be as high as 50% for the standard elements and 75% for the fuel followers. Experimental results for burnup-dependent critical configurations, cycle-averaged fuel element powers, and fuel-element-averaged ^{235}U burnups validated predictions based on three-dimensional depletion calculations. Calculated values for plutonium production and isotopic mass ratios as functions of ^{235}U burnup support the corresponding measured quantities. In general, calculations for reaction rate distributions, control rod worths, prompt neutron decay constants, and isothermal temperature coefficients were found to agree with corresponding measured values. Experimentally determined critical configurations for fresh HEU and LEU cores radially reflected with water and with beryllium are well-predicted by both Monte Carlo and diffusion calculations. 17 refs.

48610 (NIIAR–28-759) **Local facility control organization in distributed automated control systems of technological parameters.** Zhmajlo, S.A. Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR). 1988. 10p. (In Russian). Order Number DE91602411. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Logical control structure of local facilities using the distributed automated control system of fuel production line that constant in multilevel software hierarchy is considered. Multilevel control organization and some services accompanying the control operation in the chain of the command-cycle-process-task events are presented. 2 refs.; 1 fig.

2204 Control Systems

Refer also to citation(s) 48671, 49355

48611 (CONF-901101–29) **Command validation of secondary EM [electro-magnetic] pump system in the EBR-II [Experimental Breeder Reactor-II].** Bywater, R.L. (Tennessee Univ., Knoxville, TN (USA). Dept. of Nuclear Engineering); Berkan, R.C.; Upadhyaya, B.R.; Kisner, R.A. Oak Ridge National Lab., TN (USA). [1990]. 6p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. From American Nuclear Society winter meeting; Washington, DC (USA); 11-15 Nov 1990. Order Number DE90016874. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objective of command validation is to determine the relevance and accuracy of the command strategy (or control signals) generated by the control system, and to validate the resulting output of the actuator system. Actuators include pumps, valves,

control rod drive mechanisms, heaters, sprays, and other direct operations in the process. Overall command validation requires the verification of control signal input to the actuator and actuator system's design output. Accurate control strategy does not always guarantee the desired actuator output and plant response. One reason for this may be the inability of the actuator to respond to the control signals. In this study, the secondary sodium electromagnetic pump (EM pump) system in the Experimental Breeder Reactor-II (EBR-II) is selected for developing the command validation methodology. The objectives is to validate the voltage input to the EM pump (control signal) and the pump flow rate (actuator signal). Neural network models of the desired variables are developed using EBR-II start-up data. 3 refs., 1 fig., 1 tab.

48612 (CONF-901199–10) **LQG/LTR control system design for a low-pressure feedwater heater train with time delay.** Murphy, G.V. (Tennessee Univ., Knoxville, TN (USA). Dept. of Electrical Engineering); Bailey, J.M. Oak Ridge National Lab., TN (USA). [1990]. 5p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. From IECON '90; Pacific Grove, CA (USA); 27-30 Nov 1990. Order Number DE90017333. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

An LQG/LTR control system design is formulated for a feedwater heater train with output time delay. This approach involves factoring the feedwater heater train plant into nonminimum and minimum phase components to allow the design of a robust controller for the minimum phase component of the plant using the LQG/LTR technique (minimum phase method). The nonminimum phase component takes the form of an all-pass filter containing the rhp zeroes of the first-order approximation of the time delay component. Using this nonminimum phase all-pass filter, certain singular-value multiplicative error bounds can be established to obtain a stable control system when using the LQG/LTR design technique on the minimum phase component of the plant. New analysis methods using singular values are integrated into the conventional singular-value performance and stability robustness analysis procedure. These new analysis methods allow computation of the maximum allowable time delay before instability occurs for both SISO and MIMO control systems. 7 refs., 10 figs., 1 tab.

48613 (IAEA-TC–560.03, pp. 140-147) **Computer operating support system of NPP main equipment.** Lebedev, N.N. (Institute of Research and Development (USSR)); Glasov, O.N.; Podlazov, L.N. International Atomic Energy Agency, Vienna (Austria). Apr 1990. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). In *Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.* Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

This paper describes the Common Computer Operating Support System (CCOSS) installed in the Ignalinskaya NPP. The aim of the system is to quickly detect the place and cause of malfunctions and faults in all basic technological systems at an early stage of their initiation, to display the diagnostic results and to give the operator recommendations concerning possible actions. Details on the system are provided with respect to the hardware and software and the method of diagnostic used by the Expert program. Discussion about system testing procedures are also presented. (author). 4 figs.

48614 An integrated operator advisor system for plant monitoring, procedure management, and diagnosis. Bhatnagar, R. (Ohio State Univ., Columbus, OH (USA). Dept. of Mechanical and Nuclear Engineering); Miller, D.W.; Hajek, B.K.; Stasenko, J.E. *Nuclear Technology (USA),* 89(3): 81-317 (Mar 1990).

This paper reports on an integrated operator advisor system (OAS) built using generic task methodology. The operator's activities of plant monitoring, data interpretation, procedure execution, and diagnosis have been implemented as the four generic tasks in the system. The OAS is capable of identifying the abnormal functioning of the plant in terms of threats to safety, preenumerated abnormal events, and deviations from normality. After the identification of abnormal functioning, the system will identify the procedures to be executed to mitigate the consequences of abnormal functioning and will help the operator by displaying the procedure steps and monitoring the success of actions taken. The system also is capable of diagnosing the cause of abnormal functioning. The diagnosis is done in parallel to the task to procedure execution.

48615 Validating data from instruments in harsh environments: The designer's dilemma. Johnson, G.L. (Nuclear Systems Safety Program, Lawrence Livermore National Lab., Livermore, CA (US)); Schultz, E.E. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 987-991 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

Computer-based displays in nuclear power plants often validate data received from plant sensors and combine redundant data into a single reading. The Safety parameter Display System is one example of such a system. Unfortunately, many of the instruments that measure important plant parameters are exposed to extreme environments during a plant accident. These environments can induce large instrument errors that current data validation and combination methods find difficult to handle. The authors describe typical methods used to validate and combine data, illustrate the problems caused by large measurement errors, and suggest research areas where solutions to these problems might be found.

48616 Sensor validation for power plants using adaptive backpropagation neural network. Eryurek, E. (Tennessee Univ., Knoxville, TN (USA). Dept. of Nuclear Engineering); Upadhyaya, B.R. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 1040-1047 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

Signal validation and process monitoring problems in many cases require the prediction of one or more process variables in a system. The feasibility of using neural networks to characterize one variable as a function of other related variables is studied. The back propagation network (BPN) is used to develop models of signals from both a commercial power plant and the Experimental Breeder Reactor-II (EBR-II). Several innovations are made in the algorithm, the most significant of which is the progressive adjustment of the sigmoidal threshold function and wight updating terms, thus leading to the designation adaptive backpropagation neural network.

48617 Inherent reactor power controller for a metal-fueled ALMR. Wood, R.T. (Oak Ridge National Lab., TN (USA)); Wilson, T.L. Jr. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 1032-1039 (Apr 1990). DOE Contract AC05-84OR21400. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

Inherent power control for metal-fueled ALMR designs involves using reactivity thermal feedback effects to control reactor power. This paper describes how, using classical control design techniques, a control system for normal load following maneuvers was deigned for a pool-type ALMR. This design provides active control of power removal in the balance of plant, direct control of selected primary and intermediate loop temperatures, and passive control of reactor power. The inherent stability of the strong, fast reactivity feedback effects bring heat production in the core into balance with the heat removal system temperatures, which are controlled to meet power demand. A simulation of the control system successfully responded to a 10% step change in power demand by changing power at an acceptable rate without causing large temperature fluctuations or exceeding thermal limits.

2205 Environmental Aspects

Refer also to citation(s) 48663, 48667, 48729

48618 (DOE/RL–90-34) **State of Washington Department of Health, radioactive air emissions Permit FF01: Supplemental information.** USDOE Richland Operations Office, WA (USA). Sep 1990. 269p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-87RL10930. Order Number DE90017725. Source: NTIS, PC A12/MF A01 - OSTI; GPO Dep.

This document contains supplemental information pursuant to Hanford Site Permit FF-01, "Conditions and Limitations." This Supplemental information follows the format set forth in the State of Washington Department of Health form Supplemental Information for Radioactive Air Emission Sources. In accordance with the agreement reached at the March 28, 1990, meeting among the State of Washington Department of Health, US Department of Energy-Richland Operations Office, Pacific Northwest Laboratory, and Westinghouse Hanford Company, supplemental information is provided for the Plutonium-Uranium Extraction Facility, Uranium Oxide Plant, Plutonium Finishing Plant, and the Fast Flux Test Facility only, because the emissions from these facilities constitute greater than 98 percent of airborne radioactive emissions from the Hanford Site. The Section of the State of Washington Department of Health Supplemental Information form pertinent to a description of the environmental monitoring system and all of Section 3.0, General Information, can be found in Appendix A and Appendix B, respectively. The information in these sections is generic to all four facilities. Also, calendar year 1988 effluent release data is used for the dose modeling and compliance demonstration provided in Section 3.0 for each facility.

48619 (EUR–12375) **MITRA an advanced code to calculate radionuclide release from nuclear fuels under general irradiation conditions.** Gardani, M. (Commission of the European Communities, Karlsruhe (DE). European Inst. for Transuranium Elements); Ronchi, C. Commission of the European Communities, Luxembourg (Luxembourg). 1989. 73p. Source: NTIS (US Sales Only), PC A04/MF A01.

The paper presents the computer code Mitra (Multicomponent isotope transport) which has been constructed to calculate the release of radioactive fission products from nuclear fuels under non-stationary conditions. The code is based on a new integration method fo the mass transport equation in the presence of precipitation, re-solution and radioactive decay. The starting equations and the assumed physical models are briefly described in the main part of the report. A very detailed description of the formulae used and of the Mitra subprograms are presented in extended appendices.

2206 Research, Test, and Experimental Reactors

Refer also to citation(s) 48599, 48609, 48611, 48616, 48617, 48640, 48642, 48655, 48659, 48671, 48882, 49149

48620 (CONF-900873–2) **The Neutron Radiography Reactor (NRAD).** Imel, G.R.; McClellan, G.C.; Pruett, D.P. Argonne National Lab., Idaho Falls, ID (USA). [1990]. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From 1. international topical meeting on neutron radiography system design and characterization; Pembroke (Canada); 28-30 Aug 1990. Order Number DE90017829. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Neutron Radiography Reactor (NRAD) operated by Argonne National Laboratory is described in this paper. NRAD was designed to allow radiography of highly absorbing reactor fuel assemblies in the vertical position on the routine basis. 7 figs.

48621 (EUR–12522) **Prospects and future utilization.** Ahlf, J.; Roettger, H. (ed.). Commission of the European Communities, Luxembourg (Luxembourg). 1989. 407p. (In EN, DE). (CONF-8904378–: HFR Colloquium, PETTEN (Netherlands), 20-21 Apr 1989). Source: NTIS (US Sales Only), PC A18/MF A01.

These proceedings of a colloquium held in Petten on prospects and future utilization of the HFR reactor are divided into 6 sessions bearing on: - The high flux reactor - irradiation testing of fuel and material for fast breeder reactors - irradiation testing of fuel and material for high temperature reactors and light water reactors - irradiation testing for fusion reactors - neutron radiography, radioisotopes, neutron capture therapy - neutron beam research and application of neutron activation analysis.

48622 (EUR–12522, pp. 7-19) **High flux reactor Petten present and future programme.** Ahlf, J. Commission of the European Communities, Luxembourg (Luxembourg). 1989. (CONF-8904378–: HFR Colloquium, PETTEN (Netherlands), 20-21 Apr 1989). In *Prospects and future utilization.* Order Number DE91702056. Source: NTIS (US Sales Only), PC A18/MF A01.

The High Flux Reactor (HFR) in Petten, the Netherlands, is a light water cooled and moderated research reactor designed to the principles of the well-known Oak Ridge research (ORR). The reactor core is housed in a tank which in turn is inserted into a large water-filled pool. Presently the HFR is operated at 45 MW. It is exploited as a multipurpose research reactor. Within the core 17 positions are available for irradiation experiments. Another 2 are situated in the reflector inside the tank. Two pool side facilities, both with provision for moving irradiation experiments in the flux profile, are additional valuable possibilities for the execution mainly of fuel irradiations under transient conditions. In addition, 12 beam tubes of different cross-section are available. The HFR is property of the European Communities. It is operated under contract by the Netherlands Energy Research Foundation (ECN). The programme is managed by the HFR Division of the Institute for Advanced Materials, one of the 9 institutes of the Joint Research Centre (JRC) of the European Communities. The HFR programme is executed in four years' periods. The present programme period covers the years 1988-1991. The running programme is funded by a Supplementary Programme shared by the Netherlands and the Federal Republic of Germany, and by Specific Programme of the JRC. In addition a target is set for third-party contract earnings.

48623 (EUR–12522, pp. 21-55) **The HFR as research tool. Operation, maintenance and upgrading.** Zijp, W.L. (Netherlands Energy Research Foundation, Petten (NL)). Commission of the European Communities, Luxembourg (Luxembourg). 1989. (CONF-8904378–: HFR Colloquium, PETTEN (Netherlands), 20-21 Apr 1989). In *Prospects and future utilization.* Order Number DE91702056. Source: NTIS (US Sales Only), PC A18/MF A01.

This document describes the contents of an invited paper, presented at the HFR Colloquium, held in Petten, April 20-21, 1989. Information is given on the main aspects of the reactor operation, the available reactor facilities and on past, present and future activities for reactor upgrading.

48624 (EUR–12522, pp. 275-294) **Nuclear physics at the HFR.** Abrahams, K. (Netherlands Energy Research Foundation, Petten (NL)); Konijnenberg, M.W.; Stecher-Rasmussen, F.; Wervelman, R. Commission of the European Communities, Luxembourg (Luxembourg). 1989. (CONF-8904378–: HFR Colloquium, PETTEN (Netherlands), 20-21 Apr 1989). In *Prospects and future utilization.* Order Number DE91702056. Source: NTIS (US Sales Only), PC A18/MF A01.

Since the first days of the HFR operation, young physicists of Dutch universities have been working on capture gamma-ray spectroscopy, at the neutron beams. In close collaboration with university groups the FOM-ECN nuclear physics group was founded, and almost twenty doctor theses and many publications resulted. In more than twenty five years the field has changed rather considerably, as will be shown in the present lecture. Today emphasis is on very light nuclei, such as H, D, T, ^{3}He, and ^{4}He, in which meson exchange during a gamma transition is studied. A cross section of interest for studies of the sun is that of the reaction ^{3}He (n, γ) with thermal neutrons. Future nuclear physics research in Petten can be developed from the present study of few-nucleon systems. In order to strengthen the relationship with the ECN nuclear energy research plan, this program should be applied to a study of nuclear fusion. In this application our competence on nuclear polarization techniques and on gamma-ray spectroscopy is used, whereas theoretical insight is needed to understand the fusion process. More applied research is stressed but close contact with fundamental physics is considered to be vital. Unique facilities at the High Flux Reactor enable such a program.

48625 (EUR–12522, pp. 295-313) **Neutron scattering in solid state physics and materials science.** Van Dijk, C. (Netherlands Energy Research Foundation, Petten (NL)). Commission of the European Communities, Luxembourg (Luxembourg). 1989. (CONF-8904378–: HFR Colloquium, PETTEN (Netherlands), 20-21 Apr 1989). In *Prospects and future utilization.* Order Number DE91702056. Source: NTIS (US Sales Only), PC A18/MF A01.

In this talk I will give a brief overview of the research and facilities with which this is carried out, connected to the technique of

neutron scattering at the HFR. For a better understanding and appreciation of the use of neutron beams I like to start with a short introduction about the scattering properties of thermal neutrons.

48626 (EUR–12522, pp. 315-332) **Application of reactor neutrons for activation analysis.** Woittiez, J.R.W. (Netherlands Energy Research Foundation, Petten (NL)). Commission of the European Communities, Luxembourg (Luxembourg). 1989. (CONF-8904378–: HFR Colloquium, PETTEN (Netherlands), 20-21 Apr 1989). In *Prospects and future utilization.* Order Number DE91702056. Source: NTIS (US Sales Only), PC A18/MF A01.

The application of reactor neutrons for neutron activation analysis (NAA) is discussed. After an introduction into the technique, a description of the available HFR irradiation facilities is given. Subsequently instrumental NAA and NAA with post-irradiation separations are discussed in more detail. Finally, some reflections on future developments are mentioned.

48627 (ITEF–38-89) **Experimental studying the altitude distribution of the $^{63}Cu(n,\gamma)$ reaction rates in the model of the TVR-M reactor core.** Shvedov, O.V.; Balyuk, S.A.; Aitov, G.M.; Igumnov, M.M.; Krasnoshchekov, O.V.; Kukushkin, Yu.A.; Titarenko, Yu.E.; Tolochkov, S.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1989. 48p. (In Russian). Order Number DE91602523. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Results of experimental investigation into altitude distributions of $^{63}Cu(n,\gamma)$ reaction rates on the external surface of the TVR-M reactor fuel assembly are presented. Investigation is performed to ground the safety of detail design of the 80-100 MW TVR-M channel type heavy water cooled and moderated research reactor. Experiments are conducted at the MAKET critical assembly using a full-scale model of the reactor core. Methods of high-precise γ-spectrometry with NaI(Tl)-detectors are used. Based on the obtained data analysis a conclusion is drawn that an additional. Neutron bakage through horizontal, inclined and vertical channels conditions the general trends in changes of altitude distributions of the investigated reaction rates on the surface of all is fuel assemblies. 8 refs.; 26 figs.; 11 tabs.

48628 (ITEF–39-89) **Experimental studying the azimuthal-radial distributions of the $^{63}Cu(n,\gamma)$ reaction rates in the model of the TVR-M reactor core.** Shvedov, O.V. (and others); Balyuk, S.A.; Aitov, G.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1989. 24p. (In Russian). Order Number DE91602524. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The results of experimental studies of the azimuthal-radial distributions of the ^{63}Cu (n,γ) reaction rates on the surface of fuel assemblies in the TVR-M research heavy-water high-flux reactor, are presented. The experiments are carried out using a critical assembly simulating the reactor core. The analysis of the data obtained proves that azimuthal distributions in the fuel assemblies of the external row are well described by the cos G function, for the middle and internal rows deviations in azimuthal distributions from the cos G function are noticeable, being stronger in the internal row. The data obtained are a part of the program on studying real volume power distribution in the basic TVR-M reactor lattices imiting the core at the end of operational period with control rods totally with drawn. 12 figs.; 9 tabs.

48629 (ITEF–40-89) **Experimental studying the effects of horizontal experimental channels on the neutron field in the model of the TVR-M research reactor core.** Shvedov, O.V. (and others); Aitov, G.M.; Balyuk, S.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1989. 36p. (In Russian). Order Number DE91602525. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The effect of horizontal channels on the neutron field in the core of the TVR-M heavy-water cooled high-flux research reactor is experimentally studied. The experiments are carried out in a critical assembly using full-scale core model. The data are obtained characterizing soft and rigid effects of horizontal experimental channels on neutron field. The soft effect is connected with the total mass of experimental channels. It is practically uniform by the core azimuth and reveals itself in the decrease of neutron burst in the reflector, and, consequently in the decrease of neutron field distorsion in the external and middle fuel assembly rows. The rigid effect is conditioned by separate experimental channels located close to the core. It brings about local disturbance in the closest fuel assemblies. The data obtained are a part of experimental program on studying basis power distributions in the TVR-M reactor lattices. 2 refs.; 18 figs.

48630 (JAERI-M–90-063) **Analysis method of fractional release of cesium from fuel elements of HTTR.** Sawa, Kazuhiro (Japan Atomic Energy Research Inst., Oarai, Ibaraki (Japan). Oarai Research Establishment); Okamoto, Futoshi; Shiozawa, Shusaku; Sasaki, Katsunori. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 46p. (In Japanese). Order Number DE90520209. Source: NTIS (US Sales Only), PC A03/MF A01.

This report describes an analytical model and parameters to evaluate the fractional release of metallic fission product (cesium) during normal operation of High Temperature Engineering Test Reactor (HTTR). The fractional releases, which are calculated by TRAFIC code, on the basis of the present analytical model and parameters show about ten times larger than that measured in the sweep gas capsule irradiation test and the OGL-1 fuel element irradiation test. Thus, the analytical model and the parameters are concluded to be applicable to the evaluation of the cesium release from the HTTR fuel element in the safety analysis. (author).

48631 (JAERI-M–90-079) **The design and construction of the neutron guide tubes in JRR-3.** Suzuki, Masatoshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Kawabata, Yuji; Kudo, Mitsuyoshi. Japan Atomic Energy Research Inst., Tokyo (Japan). May 1990. 48p. (In Japanese). Order Number DE90520262. Source: NTIS (US Sales Only), PC A03/MF A01.

In the upgrade project of JRR-3 neutron guide tubes whose total length was about 230m were constructed. This is the first construction of a large scale neutron guide tubes in Japan, although they have been already constructed and utilized in Europe. The design of neutron guide tubes was started in 1985 and the guide tubes in JRR-3 were completed in February 1990. The result of various experiments and experience were described in this report. The major factors for the better performance of the guide tubes are the flatness of mirror surface planes, the dimensional accuracy on the fabricated elements and the alignments of each elements. The average surface roughness of the mirror planes is 0.008μm and the dimensional accuracy of the elements in 5μm on the average. On the constructed guide tubes the average horizontal and vertical errors are $1x10^{-5}$ rad and $2x10^{-5}$ rad respectively and the abutment error is $5x10^{-6}$ rad on the average. (author).

48632 (KURRI-TR–327, pp. 50-63) **Present status and subjects of ultrahigh neutron flux reactors in USA.** Mochizuki, Tetsuro (Kinki Univ., Higashi-Osaka, Osaka (Japan). Atomic Energy Research Inst.). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jan 1990. (In Japanese). (CONF-8901187–: Workshop on the cooling of high-performance reactors, Kumatori (Japan), 17-18 Jan 1989). In *Proceedings of the workshop on the cooling of high-performance reactors.* Order Number DE90777871. Source: NTIS (US Sales Only), PC A08/MF A01.

The Advanced Neutron Source (ANS) project, the planning of which is advanced at present mainly by Oak Ridge National Laboratory under US DOE, is at the final stage of preconceptual design. This reactor aims at the high neutron flux that is not experienced by mankind for the study of neutron scattering, and is equipped with the facilities for isotope production and material irradiation more than those of the high flux isotope reactor (HFIR). From Japan, also the researchers are dispatched. The required performance of the ANS reactor is shown. The split core using involute fuel plates was adopted as the reference core, and its specification is given. In this reactor, in order to realize the maximum neutron flux of 10^{20} n/m^{2}S, in the core of 27 lit., about 25 kg of U-235 is charged, and in the operation of 14 days per one cycle, about 6 kg is consumed. This core is totally replaced every one cycle. The generated heat is 325 MW, or 12 MW/lit. The surface heat flux on fuel plates is 9 MW/m^2. In order to do cooling without boiling, the

required flow velocity of coolant is 27 m/s. The core cooling, the cold neutron source, the examination of the correlation equation for burn out heat flux and so on are described. (K.I.).

2207 Plutonium and Isotope Production Reactors

Refer also to citation(s) 48660, 48669, 49352, 50170, 50171, 50172, 50173

48633 (EUR–12522, pp. 87-89) **Irradiation program of the transuranium European institute in the HFR reactor.** Campana, M. (Commission of the European Communities, Karlsruhe (DE). Joint Research Center). Commission of the European Communities, Luxembourg (Luxembourg). 1989. (In French). (CONF-8904378–: HFR Colloquium, PETTEN (Netherlands), 20-21 Apr 1989). In *Prospects and future utilization.* Order Number DE91702056. Source: NTIS (US Sales Only), PC A18/MF A01.

Short note. HFR REACTOR/research programs; LMFBR TYPE REACTORS/mixed nitride fuels; LMFBR TYPE REACTORS/mixed carbide fuels; MIXED NITRIDE FUELS/research programs; MIXED NITRIDE FUELS/testing; MIXED CARBIDE FUELS/ research programs; MIXED CARBIDE FUELS/testing; TESTING; FUEL-CLADDING INTERACTIONS; SWELLING; PLUTONIUM CARBIDES; PLUTONIUM NITRIDES

48634 (EUR–12522, pp. 93-113) **HTR components irradiation tests. Actual state and future requirements.** Kirch, N. (Kernforschungsanlage Juelich G.m.b.H. (DE)); Brinkmann, H.U.; Nabielek, H. Commission of the European Communities, Luxembourg (Luxembourg). 1989. (In German). (CONF-8904378–: HFR Colloquium, PETTEN (Netherlands), 20-21 Apr 1989). In *Prospects and future utilization.* Order Number DE91702056. Source: NTIS (US Sales Only), PC A18/MF A01.

This document lays out a rapid historical of past tests, existing and future on HTR reactor main components: fuel elements, graphite reflector, safety rods and peripheral components.

48635 (EUR–12522, pp. 59-85) **Reactor transients tests for SNR fuel elements in HFR reactor.** Plitz, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (DE)). Commission of the European Communities, Luxembourg (Luxembourg). 1989. (In German). (CONF-8904378–: HFR Colloquium, PETTEN (Netherlands), 20-21 Apr 1989). In *Prospects and future utilization.* Order Number DE91702056. Source: NTIS (US Sales Only), PC A18/MF A01.

In HFR reactor, fuel pins of LMFBR reactors are putted in irradiation specimen capsules cooled with sodium for reactor transients tests. These irradiation capsules are instrumented and the experiences realized until this day give results on: - Fuel pins subjected at a continual variation of power - melting fuel - axial differential elongation of fuel pins.

48636 (EUR–12522, pp. 237-260) **Radioisotopes production programmes for reactor radioisotopes.** Constant, R.J. (Institut National des Radioelements, Brussels (BE)); Gens, R.F.; Heeren, L.L.; Jacquemin, R.A. Commission of the European Communities, Luxembourg (Luxembourg). 1989. (CONF-8904378–: HFR Colloquium, PETTEN (Netherlands), 20-21 Apr 1989). In *Prospects and future utilization.* Order Number DE91702056. Source: NTIS (US Sales Only), PC A18/MF A01.

The NATIONAL INSTITUTE FOR RADIOELEMENTS (I.R.E.), Fleurus, Belgium, has, since its creation in 1972, continued to develop simultaneously, within the scope of reactor isotope production with applications in both medical and industrial fields, its irradiation and fission production programme. Concerning the former, we almost exclusively use the BR2 reactor but concerning the latter, we have to avail ourselves of the collaboration of 4 to 5 reactors, among these the HFR in Petten (NL). Indeed, as we shall see further on, production and delivery requirements linked to Mo-99 fission mean that a basic number of reactors is required. Among the major reactor isotopes produced at I.R.E., we should mention Ir-192, Mo-99, Xe-133, I-131 and Co-60. Other radioisotopes are also produced but in minor quantities. Each application requires an in-depth study together with the designing of apparatus and equipment, specific to each reactor.

2209 Reactor Safety

Refer also to citation(s) 48575, 48614, 48615, 49352, 49355

48637 (APC-SB–318) **Investigations of water entrainment during hypothetical reactor accidents. Final report.** Koerber, H.; Schuez, G. Angewandte Physik Consulting GmbH (APC), Stuttgart (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Feb 1989. 81p. (In German). Contract BMFT RS 1500 733. Source: Available from Angewandte Physik Consulting GmbH (APC), Stuttgart (Germany, F.R.).

The entrainment out of the boiling sump leads to partial resuspension of fission products into the containment. The entrainment is analyzed and a model is developed based on equations from the literature as well as a new correlation. The model, basically distinguishing between the momentum controlled and the stable entrainment region, is applied to experiments carried out. In the momentum controlled region the entrainment decreases rapidly with increasing height above the boiling liquid. Finally, the region of stable entrainment is reached. Further reductions in entrainment are only caused by wall deposition and are of minor influence. The new model neglects wall deposition effects with respect to reactor boundary conditions. For high and medium evaporation rates the computed results agree well with the experiments. For low evaporation rates the agreement is still satisfactorily. The evaluation of the boundary conditions in PWR containments proves the entrainment to be governed solely by the stable entrainment. As long as transient processes (flashing due to catastrophic failure of the containment) can be excluded, entrainment rates of 10^{-5} and less can be expected. Entrainment rates of 10^{-2} or 10^{-3} which have been proposed in the past are too conservative. Further, increasing pressure is shown to reduce the entrainment significantly. (orig.).

48638 (BNL-NUREG–44847) **Bounding core temperature transients for severe and rapid water ingress scenarios in modular high temperature gas-cooled reactors.** Kroeger, P.G. Brookhaven National Lab., Upton, NY (USA). [1990]. 26p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC02-76CH00016. (CONF-901101–25: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE90015125. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A rapid water ingress transient, resulting from steam generator tube or tube-sheet failures, could lead to a reactivity insertion and core heatup in the Modular High Temperature Gas-Cooled Reactors. This paper considers the effect of hypothetical rapid and severe water ingress scenarios of extremely low probability, and assesses the effect of such transients on potentially excessive fuel temperatures and subsequent fuel failures. The results indicate that for the worst postulated scenarios the conservatively set limiting fuel temperature of 1600°C is indeed exceeded, but only for a few seconds, and then only in a small fraction of the core. Therefore, it appears that even the most severe and rapid water ingress transients would not lead to significant fuel failures. Parametric variations of the key variables indicate that the reactivity worth of water and the fuel thermal properties must be established with high confidence as the design progresses. 7 refs., 11 figs., 3 tabs.

48639 (CEA-DAS–617) **The lessons drawn from accident simulation, consequences for the operation of the Crisis Technical Center of the Nuclear Safety and Protection Institut.** Manesse, D. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (FR). Dept. d'Analyse de Surete); Ney, J.; Crabol, B.; Ginot, P. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete. Jul 1989. 14p. (In French). (CONF-8905115–: 2. international workshop on real-time computing of the environmental consequences of an accidental release to the atmosphere from a nuclear installation, Luxembourg (Luxembourg), 16-19 May 1989). Order Number DE91700552. Source: NTIS (US Sales Only), PC A03/MF A01.

The aim of the work is to summarize the lessons drawn from planning and performing the nuclear accident simulation exercises. The analysis is focused on the simulation and foresight of the radiation effects. The simulation exercises allowed a progressive improvement of the technical survey organization, leading to an improvement of its availability to the authorities. The subjects which

need to be taken into account are those related to the intervention actions, in order to obtain realistic situations, the actions related to public organizations, people and communication networks.

48640 (CONF-900804–32) **Fast reactor safety testing in Transient Reactor Test (TREAT) in the 1980s.** Wright, A.E. (Argonne National Lab., IL (USA)); Dutt, D.S.; Harrison, L.J. Argonne National Lab., IL (USA). [1990]. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From International topical meeting on fast reactor safety; Snowbird, UT (USA); 12-16 Aug 1990. Order Number DE90017672. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Several series of fast reactor safety tests were performed in TREAT during the 1980s. These focused on the transient behavior of full-length oxide fuels (US reference, UK reference, and US advanced design) and on modern metallic fuels. Most of the tests addressed fuel behavior under transient overpower or loss-of-flow conditions. The test series were the PFR/TREAT tests; the RFT, TS, CDT, and RX series on oxide fuels; and the M series on metallic fuels. These are described in terms of their principal results and relevance to analyses and safety evaluation. 4 refs., 3 tabs.

48641 (CONF-901101–17) **Thermal-hydraulic impact of failure of highly irradiated fuel pins on LMR passive safety.** Dunn, F.E.; Herzog, J.P. Argonne National Lab., IL (USA). [1990]. 7p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From American Nuclear Society winter meeting; Washington, DC (USA); 11-15 Nov 1990. Order Number DE90013663. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The EBR-2 SHRT-45 loss-of-primary-flow-without scram test and SHRT 302 unprotected loss-of-heat-sink test have demonstrated that liquid metal reactors can be built with a high degree of passive safety. No fuel pins were observed to fail in these tests; but if the burnup of the fuel were pushed further, one would face the question of what could be the impact of pin failures and rapid release of plenum gas in such a transient. Also, there are questions about the impact of an unprotected rapid release of plenum gas following the failure of highly irradiated fuel during normal operation. One area of concern, and the one addressed in this document, is whether the release of gas from failed pins could interfere with the coolant flow enough to cause melting of the fuel, possibly leading to blockage of the coolant channels. To address this question, the coolant voiding model in the SASSYS-1 code was modified to account for voiding due to gas release from failed pins. This model was used to analyze both unprotected pin failures during normal operation and pin failures during a SHRT-45 type of unprotected loss-of-flow transient. 3 refs., 5 figs.

48642 (CONF-901101–19) **Practical application of passive safety features for the advanced neutron source cooling system.** Maxon, B.S. (Oak Ridge National Lab., TN (USA)); McNutt, G.R.; Miller, R. Oak Ridge National Lab., TN (USA). [1990]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From American Nuclear Society winter meeting; Washington, DC (USA); 11-15 Nov 1990. Order Number DE90014208. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper presents the results of a conceptual design study leading to the definition of a reference design for the Advanced Neutron Source (ANS) heavy water cooling system. The objective of this study was to define a cooling system that not only met the ANS goals for operating parameters, reliability, availability, and maintainability, but also utilized inherent, passive, and diverse features and characteristics to satisfy the ANS internal events core melt goal of $<10^{-5}$/year.

48643 (CONF-901101–30) **The MELTSPREAD-1 computer code for the analysis of transient spreading in containments.** Farmer, M.T.; Sienicki, J.J.; Spencer, B.W. Argonne National Lab., IL (USA). [1990]. 15p. Sponsored by Electric Power Research Institute. DOE Contract W-31109-ENG-38. Contract RP 3047-2. From American Nuclear Society winter meeting; Washington, DC (USA); 11-15 Nov 1990. Order Number DE90017695. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A one-dimensional, multicell, Eulerian finite difference computer code (MELTSPREAD-1) has been developed to provide an improved prediction of the gravity driven spreading and thermal interactions of molten corium flowing over a concrete or steel surface. In this paper, the modeling incorporated into the code is described and the spreading models are benchmarked against a simple "dam break" problem as well as water simulant spreading data obtained in a scaled apparatus of the Mk I containment. Results are also presented for a scoping calculation of the spreading behavior and shell thermal response in the full scale Mk I system following vessel meltthrough. 24 refs., 15 figs.

48644 (CONF-901101–31) **CORQUENCH: A model for gas sparging-enhanced melt-water, film boiling heat transfer.** Farmer, M.T.; Sienicki, J.J.; Spencer, B.W. Argonne National Lab., IL (USA). [1990]. 8p. Sponsored by Electric Power Research Institute. DOE Contract W-31109-ENG-38. Contract RP 3047-2. From American Nuclear Society winter meeting; Washington, DC (USA); 11-15 Nov 1990. Order Number DE90017689. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A phenomenological model (CORQUENCH) has been developed to describe the gas-sparging enhanced film boiling heat transfer between a molten pool of corium and an overlying water layer. The model accounts for thermal radiation across the vapor film, bulk liquid subcooling, interfacial area enhancement due to sparging gas, and melt entrainment into the overlying water layer. In this paper, the modeling approach is described, and a comparison with the lead-Freon 11 and lead-water film boiling experiment data of Greene is made. Predictions are then made for the case of film boiling over corium in the presence of sparging concrete decomposition gases. 15 refs., 3 figs.

48645 (CONF-901109–1) **Measurement of two-phase flow momentum with force transducers.** Hardy, J.E.; Smith, J.E. Oak Ridge National Lab., TN (USA). [1990]. 8p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers; Dallas, TX (USA); 25-30 Nov 1990. Order Number DE90008748. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Two strain-gage-based drag transducers were developed to measure two-phase flow in simulated pressurized water reactor (PWR) test facilities. One transducer, a drag body (DB), was designed to measure the bidirectional average momentum flux passing through an end box. The second drag sensor, a break through detector (BTD), was designed to sense liquid downflow from the upper plenum to the core region. After prototype sensors passed numerous acceptance tests, transducers were fabricated and installed in two experimental test facilities, one in Japan and one in West Germany. High-quality data were extracted from both the DBs and BTDs for a variety of loss-of-coolant accident (LOCA) scenarios. The information collected from these sensors has added to the understanding of the thermohydraulic phenomena that occur during the refill/reflood stage of a LOCA in a PWR. 9 refs., 15 figs.

48646 (CONF-9010185–1) **Development of the Structural Materials Information Center.** Oland, C.B.; Naus, D.J. Oak Ridge National Lab., TN (USA). [1990]. 18p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From 18. water reactor safety information meeting; Gaithersburg, MD (USA); 22 Oct 1990. Order Number DE90016521. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The US Nuclear Regulatory Commission has initiated a Structural Aging Program at the Oak Ridge National Laboratory to identify potential structural safety issues related to continued service of nuclear power plants and to establish criteria for evaluating and resolving these issues. One of the tasks in this program focuses on the establishment of a Structural Materials Information Center where data and information on the time variation of concrete and other structural material properties under the influence of pertinent environmental stressors and aging factors are being collected and assembled into a data base. This data base will be used to assist in the prediction of potential long-term deterioration of critical structural components in nuclear power plants and to establish limits on hostile environmental exposure for these structures and materials.

Two complementary data base formats have been developed. The Structural Materials Handbook is an expandable, hard-copy reference document that contains complete sets of data and information for selected portland cement concrete, metallic reinforcement, prestressing tendon, and structural steel materials. Baseline data, reference properties and environmental information are presented in the handbook as tables, notes and graphs. The handbook, which will be published in four volumes, serves as the information source for the electronic data base. The Structural Materials Electronic Data Base is accessible by an IBM-compatible personal computer and provides an efficient means for searching the various data base files to locate materials with similar properties. Properties will be reported in the International System of Units (SI) and in customary units whenever possible. 7 refs., 3 figs., 4 tabs.

48647 (DOE/OR/00033–T442) **Contribution of Anticipated Transients Without Scram (ATWS) to core melt at United States nuclear power plants.** Giachetti, R.T. (Giachetti (Richard T.), Ann Arbor, MI (USA)). Oak Ridge Associated Universities, Inc., TN (USA). Sep 1989. 134p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-76OR00033. Order Number DE90017508. Source: NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

This report looks at WASH-1400 and several other Probabilistic Risk Assessments (PRAs) and Probabilistic Safety Studies (PSSs) to determine the contribution of Anticipated Transients Without Scram (ATWS) events to the total core melt probability at eight nuclear power plants in the United States. After considering each plant individually, the results are compared from plant to plant to see if any generic conclusions regarding ATWS, or core melt in general, can be made. 8 refs., 34 tabs.

48648 (EUR–12269) **Radioactivity measurements in Europe after the Chernobyl accident: Part I: Air.** Raes, F. (Commission of the European Communities, Ispra (Italy). Joint Research Centre); Graziani, G.; Grossi, L.; Marciano, L.; Peirs, D.; Pedersen, B.; Stanners, D.; Zarimpas, N. Commission of the European Communities, Luxembourg (Luxembourg). 1989. 249p. Source: NTIS (US Sales Only), PC A11/MF A01.

The data base presented is being set up primarily for scientific studies such as the validation of long range transport models, physico-chemical behaviour of radionuclides in air, etc. The data were extracted from the REM Data Bank at the Joint Research Centre of the Commission of the European Communities at Ispra. The data where originally obtained from written reports or were copied directly from tapes or diskettes into the REM Data Bank. In the latter case, verification with written material was persued. The original sources are given in the references. In preparing this report, only those data were retained which were fully specified as far as time, location and measuring techniques are concerned, i.e.: beginning and end of sampling, geographical coordinates and types of filters are known.

48649 (EUR–12273) **Summary report on safety objectives in nuclear power plants.** Commission of the European Communities, Luxembourg (Luxembourg). 1989. 77p. Source: NTIS (US Sales Only), PC A05/MF A01.

The special Task Force on Safety Objectives of the Commission of the European Communities (CEC) Working Group on the Safety of Light Water Reactors reported in May 1983 on its review of existing overall safety objectives in nuclear power plants. Since then much relevant worlwide activity has taken place. This report reviews those activities that have taken place since 1983 in European Community Member States, including more recent Members, as well as in Sweden and Finland. The report confines itself to issues related to probabilistic safety objectives, and concludes that significant progress has been made in many areas. Mutual understanding of safety objectives is leading to a convergence of views and approaches, but it is noted that much work remains to be completed.

48650 (EUR–12276) **An appreciation of the events, models and data used for LMFBR radiological source term estimations.** Keir, D. (UKAEA Safety and Reliability Directorate, Culcheth (UK)); Clough, P.N. Commission of the European Communities, Luxembourg (Luxembourg). 1989. 95p. Contract No. ECI-1478-B-7221-86 UK. Source: NTIS (US Sales Only), PC A05/MF A01.

In this report, the events, models and data currently available for analysis of accident source terms in liquid metal cooled fast neutron reactors are reviewed. The types of hypothetical accidents considered are the low probability, more extreme types of severe accident, involving significant degradation of the core and which may lead to the release of radionuclides. The base case reactor design considered is a commercial scale sodium pool reactor of the CDFR type. The feasibility of an integrated calculational approach to radionuclide transport and speciation (such as is used for LWR accident analysis) is explored. It is concluded that there is no fundamental obstacle, in terms of scientific data or understanding of the phenomena involved, to such an approach. However this must be regarded as a long-term goal because of the large amount of effort still required to advance development to a stage comparable with LWR studies. Particular aspects of LMFBR severe accident phenomenology which require attention are the behaviour of radionuclides during core disruptive accident bubble formation and evolution, and during the less rapid sequences of core melt under sodium. The basic requirement for improved thermal hydraulic modelling of core, coolant and structural materials, in these and other scenarios, is highlighted as fundamental to the accuracy and realism of source term estimations. The coupling of such modelling to that of radionuclide behaviour is seen as the key to future development in this area.

48651 (EUR–12490) **Adaptation of high pressure water jets with abrasives for nuclear installations dismantling.** Rouviere, R. (CEA Etablissement de la Vallee du Rhone 30 - Bagnols-sur-Ceze (FR)); Pinault, M.; Gasc, B.; Guiadeur, R.; Pilot, M. Commission of the European Communities, Luxembourg (Luxembourg). 1989. 95p. (In French). contract no FI1D-0067. Source: NTIS (US Sales Only), PC A05/MF A01.

This report presents the work realized for adjusting the cutting technology with high pressure water jet with abrasives for nuclear installation dismantling. It has necessitated the conception and the adjustment of a remote tool and the realization of cutting tests with waste product analysis. This technic can be ameliorated with better viewing systems and better fog suction systems.

48652 (IAEA-INFCIRC–383) **Information on economic and social consequences of the Chernobyl accident.** International Atomic Energy Agency, Vienna (Austria). Jul 1990. 16p. Order Number DE91601970. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Hard copies are available in English and Russian from IAEA Division of Publications, Distribution Unit.

This "Information on economic and social consequences of the Chernobyl accident" was presented to the July 1990 session of the Economic and Social Council of the United Nations by the delegations of the Union of Soviet Socialist Republics, the Byelorussian Soviet Socialist Republic and the Ukrainian Soviet Socialist Republic. It presents the radiation situation, the medical aspects of the accident, the evacuation of the inhabitants from areas affected by radioactive contamination and their social welfare, the agro-industrial production and forestry in these areas, the decontamination operations, the scientific back-up for the work dealing with the consequences of the accident and the expenditure and losses resulting from the Chernobyl disaster.

48653 (IAEA-TC–560.03) **Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989.** International Atomic Energy Agency, Vienna (Austria). Apr 1990. 212p. (CONF-8904376–: Technical committee/workshop on computer aided safety analysis, Berlin (German Democratic Republic), 17-21 Apr 1989). Order Number DE91602443. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The meeting was conducted in a workshop style, to encourage involvement of all participants during the discussions. Forty-five (45) experts from 19 countries, plus 22 experts from the GDR participated in the meeting. A list of participants can be found at the end of this volume. Forty-two (42) papers were presented and discussed during the meeting. Additionally an open discussion was held on the possible directions of the IAEA programme on Computer Aided Safety Analysis. A summary of the conclusions of these discussions is presented in the publication. The remainder of

this proceedings volume comprises the transcript of selected technical papers (22) presented in the meeting. It is the intention of the IAEA that the publication of these proceedings will extend the benefits of the discussions held during the meeting to a larger audience throughout the world. The Technical Committee/Workshop on Computer Aided Safety Analysis was organized by the IAEA in cooperation with the National Board for Safety and Radiological Protection (SAAS) of the German Democratic Republic in Berlin. The purpose of the meeting was to provide an opportunity for discussions on experiences in the use of computer codes used for safety analysis of nuclear power plants. In particular it was intended to provide a forum for exchange of information among experts using computer codes for safety analysis under the Technical Cooperation Programme on Safety of WWER Type Reactors (RER/9/004) and other experts throughout the world. A separate abstract was prepared for each of the 22 selected papers. Refs, figs tabs and pictures.

48654 (IS-M–619) **Effects of design details on the capacity of steel containment buildings.** Greimann, L. (Ames Lab., IA (USA)); Fanous, F.; Rogers, J. Ames Lab., IA (USA). [1988]. 13p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-7405-ENG-82. (CONF-880616–6: 4. workshop on integrity of containments for nuclear power plants, Arlington, VA (USA), 14-17 Jun 1988). Order Number DE90016700. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Containment Integrity Division of the Sandia National Laboratories (Sandia) conducted experimental and analytical investigations to evaluate the performance of containment buildings with internal pressure. Sandia has suggested that, in the absence of leakage through penetration openings, containment buildings will fail by rupturing as large plastic strains approach the ultimate strain of the material. This paper represents a portion of work conducted at Ames Laboratory for Sandia, the objective of which was to identify fabrication details that may affect the performance of a containment building. Construction drawings for nine steel containment buildings as well as the Sandia 1:8-scale model were surveyed, and several significant strain concentration regions were identified following the recommendations from Sandia and Section NE-3217 of the ASME Boiler and Pressure Vessel Code. 12 refs., 3 figs., 1 tab.

48655 (JAERI-M–90-070) **Safety demonstration test plan in the High Temperature Engineering Test Reactor (HTTR) and safety evaluation.** Kunitomi, Kazuhiko (Japan Atomic Energy Research Inst., Oarai, Ibaraki (Japan). Oarai Research Establishment); Maruyama, So; Shindoh, Masami; Sudo, Yukio. Japan Atomic Energy Research Inst., Tokyo (Japan). Apr 1990. 50p. (In Japanese). Order Number DE90520212. Source: NTIS (US Sales Only), PC A03/MF A01.

Safety demonstration tests in the HTTR (High Temperature Engineering Test Reactor) will be carried out to verify inherent safety features of the HTGR (High Temperature Gas-cooled Reactor). The tests include a decrease of primary coolant flow rate and a control rod withdrawal at the power operation. The reliability of the safety design and safety evaluation method of the HTTR is confirmed by the comparison between the experimental and analytical results. This report describes the test program, test method, test condition and safety evaluation of the safety demonstration tests in the HTTR. (author).

48656 (JAERI-M–90-073) **An intermediate break BWR LOCA test (RUN 991) at ROSA-III: Simulation of ECCS line break LOCA phenomena.** Suzuki, Mitsuhiro (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Anoda, Yoshinari; Kumamaru, Hiroshige; Nakamura, Hideo; Yonomoto, Taisuke; Murata, Hideo; Tasaka, Kanji. Japan Atomic Energy Research Inst., Tokyo (Japan). Apr 1990. 171p. Order Number DE90520220. Source: NTIS (US Sales Only), PC A08/MF A01.

Double failures on the emergency-core-cooling systems (ECCSs) can be resulted in a case of loss-of-coolant accident (LOCA) of a boiling water reactor (BWR) by assuming an ECCS line break and the single failure criterion on another ECCS. In the Rig-of-Safety Assessment (ROSA)-III program, two BWR LOCA simulation tests with intermediate break areas were performed to experimentally study influences of the ECCS double failures on core cooling phenomena. As there was no break unit in the ROSA-III ECCS lines, two break locations were selected above and below the ECCS line elevation. Namely, one is a main steam line (MSL) break test of RUN 992 which was previously reported. Another one is a single-ended jet pump drive line (JPDL) break test of RUN 991. And this break location effect on the system responses was briefly studied in a report of JAERI 1307. This report presents precise experiment results of RUN 991 with respect to the core cooling phenomena related to transient system mass and also presents additional findings on the influences of ECCS double failures in some intermediate break LOCA tests including above two tests. (author).

48657 (JAERI-M–90-080) **Evaluation report on SCTF Core-III Test S3-20: Investigation of water break-through and core cooling behaviors under intermittent ECC water delivery to upper plenum during reflood phase in PWRs with combined-injection type ECCS.** Okubo, Tsutomu (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Iguchi, Tadashi; Iwamura, Takamichi; Akimoto, Hajime; Ohnuki, Akira; Abe, Yutaka; Adachi, Hiromichi; Murao, Yoshio; Sakaki, Isao. Japan Atomic Energy Research Inst., Tokyo (Japan). May 1990. 107p. Order Number DE90520264. Source: NTIS (US Sales Only), PC A06/MF A01.

During the reflood phase of the loss-of-coolant accident (LOCA) in a Pressurized Water Reactor (PWR) with the combined-injection type Emergency Core Cooling System (ECCS), the ECC water injected into the hot legs is considered to be delivered to the upper plenum. There are some information which show that the ECC water delivery to the upper plenum is intermittent due to steam condensation in the hot legs. A test (Test S3-20) was conducted with the Slab Core Test Facility (SCTF) Core-III in order to investigate the water break-through and core cooling behaviors under the intermittent ECC water delivery to the upper plenum during the reflood phase. In this test, the subcooled ECC water was injected intermittently just above the upper core support plate above Bundles 7 and 8 of the core. The average injection rate was set to be the same as that in SCTF Test S3-13, which was conducted under an Evaluation Model condition with continuous ECC water injection. Analyzing the test data together with those of Test S3-13, the following has been found: (1) The break-through occurred intermittently immediately corresponding to the intermittent ECC water injection. When the break-through occurred, there observed two different thermo-hydrodynamic behaviors between the break-through region and the non-break-through region. (2) During the periods when the ECC water injection was nearly zero, the core water head decreased and this resulted in degradation of the core cooling in those periods. The reason of the decrease in the core water head is considered to be the increase in the intact loop differential pressure due to the decrease in the steam condensation in the upper plenum. (3) Although the core cooling behavior was oscillatory, it has been found to be nearly identical to that for the continuous injection case. (J.P.N.).

48658 (KAPL–4718) **Scaling of two-phase flow regimes in a rod bundle with freon.** Symolon, P.D. Knolls Atomic Power Lab., Schenectady, NY (USA). Jul 1990. 38p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC12-76SN00052. Order Number DE90016661. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Fluid to fluid modeling of the thermal-hydraulics of steam/water systems using Freon has been the subject of research for the past 25 years. However, there is as yet no universally accepted set of scaling laws to define the geometry and velocity scaling requirements of an equivalent Freon test of the full scale steam/water system being simulated. This paper describes a scaling concept where the Weber and Froud numbers of the Freon model are matched to that of the prototype being simulated, thus creating a comparable balance among inertia, surface tension and buoyancy forces. In this test it was demonstrated that similar flow regime transitions are observed in a half scale Freon simulation of a full scale steam/water test run at Dynatech. It is also shown using a two fluid analytical model and existing correlations for friction and interfacial momentum exchange from the open literature, that a half scale simulation leads to nearly the same slip ratio as for full scale steam/water, while the slip ratio for a full scale Freon simulation is

too high. A comparison of the predicted flow distribution in the 4-rod bundle is made using the COBRA-IV code for a full scale simulation using Freon, a half scale simulation using Freon and full scale test with water. The COBRA results demonstrated that a half scale test section model using Freon yields a subchannel flow distribution similar to the steam/water case, while a full scale Freon simulation results in a distorted subchannel flow distribution. It is concluded that the appropriate geometric scale factor for Freon simulation of two-phase steam/water flow in tube bundles is one-half for a broad range of thermal-hydraulic conditions. 24 refs., 12 figs., 4 tabs.

48659 (LA-UR-90-1833) **Simulation of three-dimensional hydrodynamic components with a one-dimensional transient analysis code.** Shaw, R.A. (Los Alamos National Lab., NM (USA)); Davis, C.B. Los Alamos National Lab., NM (USA). [1990]. 8p. Sponsored by Nuclear Regulatory Commission. DOE Contract W-7405-ENG-36. (CONF-901101-3: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE90012059. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The RELAP5 series of transient analysis codes was developed to provide the United States Nuclear Regulatory Commission with a fast-running and user convenient reactor analysis tool. Although it was developed primarily for best-estimate transient simulation of pressurized water reactors, it has been used to simulate a wide spectrum of hydraulic and thermal transients in both nuclear and non-nuclear systems involving steam-water-noncondensible fluid mixtures. In recent years it has also been applied to thermal-hydraulic analyses of various US Department of Energy production reactors. RELAP5 is a one-dimensional code, meaning that the basic field equations are solved only in the axial direction of a component. Thus, for example, only axial flow is calculated in a reactor vessel; radial and azimuthal flows are not considered. This has been a minor limitation of the code because most hydraulic situations in reactor systems can be modeled adequately with a one-dimensional code. In those situations where three-dimensional flows were anticipated, the TRAC-PF1 code has generally been used. (TRAC-PF1 has the capability to model three-dimensional components; however, that option is normally only used in the reactor vessel model.) This paper describes the RELAP5 hexagonal model of the SRS L-Reactor as well as comparisons of benchmark calculations with SRS data. Emphasis is placed on the multidimensional phenomena. 6 refs., 6 figs.

48660 (LA-UR-90-2777) **Modeling issues associated with production reactor safety assessment.** Stack, D.W. (Los Alamos National Lab., NM (USA)); Thomas, W.R. Los Alamos National Lab., NM (USA). [1990]. 7p. Sponsored by Nuclear Regulatory Commission. DOE Contract W-7405-ENG-36. (CONF-9002139-1: Probabilistic safety assessment and management conference (PSAM), Beverly Hills, CA (USA), 4-7 Feb 1990). Order Number DE90016492. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper describes several Probabilistic Safety Assessment (PSA) modeling issues that are related to the unique design and operation of the production reactors. The identification of initiating events and determination of a set of success criteria for the production reactors is of concern because of their unique design. The modeling of accident recovery must take into account the unique operation of these reactors. Finally, a more thorough search and evaluation of common-cause events is required to account for combinations of unique design features and operation that might otherwise not be included in the PSA. It is expected that most of these modeling issues also would be encountered when modeling some of the other more unique reactor and nonreactor facilities that are part of the DOE nuclear materials production complex. 9 refs., 2 figs.

48661 (MIC-90-03528/XAB) **Wind force measurement on a model fuelling-machine trolley in a simulated LOCA.** Chan, A.M.C.; Russell, J.H. Ontario Hydro, Toronto, ON (Canada). Research Div. ©1989. 42p. Source: NTIS, PC EE07/MF E01.

Description of a series of tests to measure the drag force on a fuelling machine trolley model during a simulated loss of coolant accident in a multi-unit nuclear power station using an air blowdown facility. The test facility consists of 1/40th scale model of a Bruce Nuclear Generating Station reactor vault, part of the fuelling machine duct and 2 fuelling machine trolleys. Accidents were simulated by discharging high pressure air from 2 large holding tanks through the tunnel. To simulate prototype accident conditions, local Mach numbers of up to 0.175 and 0.15 were obtained for the one and two trolley cases respectively.

48662 (ND-R-1173(S)-Pt.2) **The MERLIN programme: Pt. 2, A description of the MERLIN rig.** Worswick, D. UKAEA Northern Research Labs., Springfields (UK). Sep 1989. 38p. (PWR/FBWG/P-(86)397-Pt.2;PWR/HTWG/P-(86)440-Pt.2). Order Number DE90706194. Source: NTIS (US Sales Only), PC A03/MF A01 - OSTI.

The MERLIN rig at the Springfields Nuclear Power Development Laboratories is intended to investigate the deformation behviour of PWR Zircaloy fuel rod cladding under conditions approximating those of a large break LOCA. An assembly of electrically heated fuel rod simulators (6 x 6 cluster) can be subjected to a temperature transient including the initiation of bottom reflooding at a suitable stage. The Zircaloy cladding can deform under the influence of the simulator gas filling pressure, causing sub-channel blockage which can be assessed after the test has been completed. This report describes the design of the MERLIN rig and draws attention to some of the strengths of the design which enable it to model some of the factors known to be important in the ballooning process.

48663 (NUREG/CR-4624-Vol.6) **Radionuclide release calculations for selected severe accident scenarios: Supplemental calculations.** Denning, R.S. (Battelle Columbus Div., OH (USA)); Leonard, M.T.; Cybulskis, P.; Lee, K.W.; Kelly, R.F.; Jordan, H.; Schumacher, P.M.; Curtis, L.A. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Battelle Columbus Div., OH (USA). Aug 1990. 359p. Sponsored by Nuclear Regulatory Commission. (BMI-2139-Vol.6). Source: NTIS, PC A17/MF A01 - GPO; OSTI; INIS.

This report provides the results of source term calculations that were performed in support of the NUREG-1150 study. "Severe Accident Risks: An Assessment for Five US Nuclear Power Plants." This is the sixth volume of a series of reports. It supplements results presented in the earlier volumes. Analyses were performed for three of the NUREG-1150 plants: Peach Bottom, a Mark I, boiling water reactor; Surry, a subatmospheric containment, pressurized water reactor; and Sequoyah, an ice condenser containment, pressurized water reactor. Complete source term results are presented for the following sequences: short term station blackout with failure of the ADS system in the Peach Bottom plant; station blackout with a pump seal LOCA for the Surry plant; station blackout with a pump seal LOCA in the Sequoyah plant; and a very small break with loss of ECC and spray recirculation in the Sequoyah plant. In addition, some partial analyses were performed which did not require running all of the modules of the Source Term Code Package. A series of MARCH3 analyses were performed for the Surry and Sequoyah plants to evaluate the effects of alternative emergency operating procedures involving primary and secondary depressurization on the progress of the accident. Only thermal-hydraulic results are provided for these analyses. In addition, three accident sequences were analyzed for the Surry plant for accident-induced failure of steam generator tubes. In these analyses, only the transport of radionuclides within the primary system and failed steam generator were examined. The release of radionuclides to the environment is presented for the phase of the accident preceding vessel meltthrough. 17 refs., 176 figs., 113 tabs.

48664 (NUREG/CR-5254) **Bias in peak clad temperature predictions due to uncertainties in modeling of ECC bypass and dissolved non-condensable gas phenomena.** Rohatgi, U.S. (Brookhaven National Lab., Upton, NY (USA)); Neymotin, L.Y.; Jo, J.; Wulff, W. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Brookhaven National Lab., Upton, NY (USA). Sep 1990. 159p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC02-76CH00016. (BNL-NUREG-52168). Source: NTIS, PC A08/MF A01 - GPO; OSTI; INIS.

This report describes a general method for estimating the effect on the Reflood Phase PCT from systematic errors (biases) associated with the modelling of the ECCS and dissolved nitrogen, and the application of this method in estimating biases in the Reflood

Phase PCT (second PCT) predicted by the TRAC/PF1/MOD1, Version 14.3. The bias in the second PCT due to the uncertainty in the existing code models for ECCS related phenomena is −19°K (−34°F). The negative bias implies that the code models for this phenomena are conservative. The bias in the second PCT due to the lack of modelling of dissolved N_2 in the code is estimated to be 9.9°K (17.8°F). The positive bias implies that the absence of dissolved N_2 model makes the code prediction of PCT non-conservative. The bias estimation in this report is a major exception among all other uncertainty and bias assessments performed in conjunction with the CSAU methodology demonstration, because this bias estimation benefitted from using full-scale test data from the full-scale Upper Plenum Test Facility (UPTF). Thus, the bias estimates presented here are unaffected by scale distortions in test facilities. Data from small size facilities were also available and an estimate of bias based on these data will be conservative. 35 refs., 18 figs., 5 tabs.

48665 (NUREG/CR–5395-Vol.11) **Multiloop Integral System Test (MIST): Final report: MIST phase 4 tests: Volume 11.** Geissler, G.O. (Babcock and Wilcox Co., Lynchburg, VA (USA). Nuclear Power Div.). Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Electric Power Research Inst., Palo Alto, CA (USA); Babcock and Wilcox Owners Group, Lynchburg, VA (USA); Babcock and Wilcox Co., Lynchburg, VA (USA). Nuclear Power Div.; Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div. Aug 1990. 524p. Sponsored by Electric Power Research Institute; Nuclear Regulatory Commission. (EPRI-NP–6480-Vol.11;BAW–2067-Vol.11). Source: NTIS, PC A22/MF A01 - GPO; OSTI; INIS.

The Multiloop Integral System Test (MIST) is part of a multiphase program started in 1983 to address small-break loss-of-coolant accidents (SBLOCAs) specific to Babcock & Wilcox designed plants. MIST is sponsored by the US Nuclear Regulatory Commission, the Babcock & Wilcox Owners Group, the Electric Power Research Institute, and Babcock and Wilcox. The unique features of the Babcock & Wilcox design, specifically the hot leg U-bends and steam generators, prevented the use of existing integral system data or existing integral facilities to address the thermal-hydraulic SBLOCA questions. MIST and two other supporting facilities were specifically designed and constructed for this program, and an existing facility–the Once-Through Integral System (OTIS)–was also used. Data from MIST and the other facilities will be used to benchmark the adequacy of system codes, such as RELAP5 and TRAC, for predication abnormal plant transients. The MIST Program is reported in 11 volumes. The program is summarized in Volume 1; Volumes 2 through 8 describes groups of tests by test type, Volume 9 presents inter-group comparisons, Volume 10 provides comparisons between the calculations of RELAP5/MOD2 and MIST observations, and Volume 11 presents the later Phase 4 tests. This Volume 11 pertains to MIST Phase IV tests performed to investigate risk dominant transients and non-LOCA events. 12 refs., 229 figs., 36 tabs.

48666 (NUREG/CR–5395-Vol.11-Add.) **Multiloop Integral System Test (MIST): Final report: MIST Phase 4 tests.** Geissler, G.O. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Electric Power Research Inst., Palo Alto, CA (USA); Babcock and Wilcox Owners Group, Lynchburg, VA (USA); Babcock and Wilcox Co., Lynchburg, VA (USA). Nuclear Power Div.; Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div. Aug 1990. 265p. Sponsored by Electric Power Research Institute; Nuclear Regulatory Commission. (EPRI-NP–6480-Vol.11-Add.;BAW–2099-Vol.11-Add.). Source: NTIS, PC A12/MF A01 - GPO; OSTI; INIS.

The Multiloop Integral System Test (MIST) is part of a multiphase program started in 1983 to address small-break loss-of-coolant accidents (SBLOCAs) specific to Babcock & Wilcox designed plants. MIST is sponsored by the US Nuclear Regulatory Commission, the Babcock & Wilcox Owners Group, the Electric Power Research Institute, and Babcock & Wilcox. The unique features of the Babcock & Wilcox design, specifically the hot leg U-bends and steam generators, prevented the use of existing integral system data or existing integral facilities to address the thermal-hydraulic SBLOCA questions. MIST and two supporting facilities were specifically designed and constructed for this program, and an existing facility – the Once-Through Integral System (OTIS) – was also used. Data from MIST and the other facilities will be used to benchmark the adequacy of system codes, such as RELAP5 and TRAC, for predicting abnormal plant transients. The MIST Program is reported in 11 volumes. The program is summarized in Volume 1; Volumes 2 through 8 describes groups of tests by test type, Volume 9 presents inter-group comparisons; Volume 10 provides comparisons between the calculations of RELAP5/MOD 2 and MIST observations, and Volume 11 presents the later Phase 4 tests. This Volume 11 addendum pertains to MIST natural circulation tests. 2 refs., 161 figs., 8 tabs.

48667 (NUREG/CR–5575) **Quantitative analysis of potential performance improvements for the dry PWR [pressurized water reactor] containment.** Kelly, D.L. (EG and G Idaho, Inc., Idaho Falls, ID (USA)); Pafford, D.J.; Schroeder, J.A.; Jones, K.R. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution; EG and G Idaho, Inc., Idaho Falls, ID (USA). Aug 1990. 158p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (EGG–2602). Source: NTIS, PC A08/MF A01 - GPO; OSTI; INIS.

This report calculates the risk benefit associated with potential performance improvements for the large dry pressurized water reactor (PWR) containment. The analysis is based on the June 1989 draft NUREG-1150 results for the Zion commercial nuclear reactor. Simplified containment event trees and the large accident progression event trees from draft NUREG-1150 are used to evaluate the effects of the potential improvements on the response of the Zion containment to dominant severe accident sequences. Source terms are generated parametrically using the ZISOR code and offsite consequences are calculated with the MELCOR Accident Consequence Code System (MACCS). These results give point estimates of the risk reduction associated with each containment improvement identified by Brookhaven National Laboratory in their draft Issues Characterization Report. 12 refs., 22 figs., 55 tabs.

48668 (ORNL/FTR–3737) **[Reactor dosimetry]: Foreign trip report, August 24, 1990–September 4, 1990.** Maerker, R.E. Oak Ridge National Lab., TN (USA). 17 Sep 1990. 11p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90017872. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler contributed two papers including an invited oral presentation on "Parameter and Flux Covariances in LEPRICON," announced the general availability of the LEPRICON code system through the Radiation Shielding Information Center in Oak Ridge, and participated significantly in two workshops held during the meeting. He also acquired information involving European activities in the calculation and adjustment of fluence rates at dosimeter locations and throughout the pressure vessels of pressurized water reactors. The most startling revelation from this face-to-face interchange was the apparent lack of concern of the Europeans in the inadequacy of the ENDF/B-IV and V iron cross sections to provide accurate comparisons with dosimetry measurements. Perhaps this is at least partially explained by their lack of dosimetry data so far in the reactor cavities where calculations are much more sensitive to these cross sections. There is also still a sloppiness apparent in some countries in their methods for comparing calculated and measured quantities, which tends to distort some of their conclusions. Overall, however, there has been a marked improvement over the past few hears exhibited by the Europeans in their ability to perform fluence rate calculations. They still have a long way to go in their adjustment procedures, however.

48669 (WHC-SA–0821) **N reactor external events probabilistic risk assessment using NUREG-1150 methods.** Wang, O.S.; Baxter, J.T.; Coles, G.A.; Zentner, M.D.; Powers, T.B.; Collard, L.B.; Rainey, T.E. Westinghouse Hanford Co., Richland, WA (USA). [1990]. 19p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. Order Number DE90017729. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This is the first full-scope Level-III PRA completed for the DOE Category A reactor using the updated NUREG-1150 methods. The comparisons to the quantitative NRC safety objectives and DOE nuclear safety guidelines also set analytical precedent for DOE production reactors. Generally speaking, the risks of operating N

Reactor are low because of a combination of factors such as low power density, large confinement volume, effective redundant scram systems and core cooling systems, remote location, etc. This work has been a major effort to evaluate the N Reactor risk using state-of-the-art PRA technology. It is believed that this PRA has resulted in realistic, or slightly conservative, results (as opposed to unduly conservative or nonconservative results). The study concluded that the risk to the public and to nearby DOE workers from the operation of N Reactor is very low. This analysis also found that N Reactor meets all the quantitative NRC safety objectives and DOE nuclear safety guidelines, and is generally as safe as, or safer than most commercial reactors in terms of societal and individual risks. The calculated risk to Hanford onsite workers is comparable to public risk from commercial reactors in the NUREG-1150 study. As a result of these low-risk estimates, only a small effort has been devoted to identifying significant risk reduction alternatives. 22 refs., 2 figs., 10 tabs.

48670 **An analysis of containment venting as a severe accident mitigation strategy for the BWR Mark II containment.** Kelly, D.L. (Idaho National Engineering Lab., Idaho Falls, ID (USA)); Galyean, W.J. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 1001-1021 (Apr 1990). DOE Contract AC07-76ID01570. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

An evaluation of a BWR/4 reactor with a Mark-II containment has identified the effects of containment venting on core damage frequency and containment failure mode, and has performed a limited evaluation of the effects on the off-site consequences. The analysis was founded upon an existing probabilistic risk assessment (PRA) with the addition of a proposed filtered containment venting system, based on the Swedish Filtra system installed at the Barseback nuclear power station in southern Sweden. Three different containment venting strategies were examined for their effects on plant risk. These are discussed.

48671 **SPERT-II benchmarks of a dynamic model for the advanced neutron source reactor.** Ibn-Khayat, M. (Univ. of Tennessee, Knoxville, TN (US)); Dodds, H.L.; March-Leuba, J. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(3): 1411-1414 (Jun 1990). DOE Contract AC05-84OR21400. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

This paper documents a series of benchmark calculations performed with a dynamic model of the advanced neutron source reactor against data from the SPERT-II experiments. Satisfactory agreement has been obtained for the SPERT-II long period transients that did not involve localized boiling. The present dynamic model represents the reactor core, the vessel and the primary system as lumped parameter equations. The neutronics module uses the point kinetics approximation and effective reactivity feedbacks computed from one-node representations of the average fuel and coolant channels. Hot spot fuel temperatures are estimated using the outlet coolant conditions of the hot channel. Single phase lumped parameter equations are used to model the primary coolant circuits that include piping, heat exchangers, pumps, and a let-down-makeup system.

24 POWER TRANSMISSION AND DISTRIBUTION

Refer also to citation(s) 48443, 48445, 50236

2401 Power Systems

Refer also to citation(s) 48449

48672 (CSCE–CE03117, pp. 291-306) **Energy reliability and the planning of power generating equipment.** Richard, D. (Hydro Quebec, Montreal, PQ (Canada)). Canadian Society for Civil Engineering, Montreal, PQ (Canada). 1987. (CONF-8705408–: 8. Canadian hydrotechnical conference, Montreal (Canada), 19-22 May 1987; CE–03117). In *Eighth Canadian hydrotechnical conference: Proceedings.* Source: Canadian Society for Civil Engineering, 2050 Mansfield St., Montreal, PQ, CAN . Prices: $30.00 CAN.

This paper describes a new approach to the evaluation of energy reliability of a system of inter-connected hydroelectric power generating plants while indicating means to include this reliability criteria within the equipment planning process. In this approach, energy reliability is defined as the probability that the system of power generating plants meet the future energy demand. Variability of natural water inflows and the uncertainty of the demand for electrical energy are the two main factors explaining the failure risk of any power plants system. The mathematical model which has been developed is a stochastic optimizer that uses dynamic programming as the method of resolution. This model is discussed and illustrated with a numerical example. Finally, curves are obtained which allow one to choose an equipment program that will offer the maximum benefit for a given level of risk. 3 refs., 6 figs., 1 tab.

2402 Power System Networks, Transmission and Distribution

Refer also to citation(s) 48749

2403 Power Transmission Lines and Cables

Refer also to citation(s) 48467

48673 (CRIE-U–89046) **Development of buried cable location survey system by underground rader for power distribution cables under pavements.** Suzuki, K.; Kitano, K. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Jun 1990. 38p. (In Japanese). Order Number DE91701391. Source: NTIS (US Sales Only), PC A03/MF A01.

To execute construction work for power distribution cables under pavements reasonably, it is important to develop a technology capable of non-destructive detection of the location of existing buried cables from the ground surface. This study is to clarify the principle, measurement method, effectiveness, and limitation of the underground radar system which is at present considered as the most effective survey method for buried cables. In this system, accuracy in measuring the depth of underground cable location by a separated type antenna has been improved, software to improve resolution by a migration process has been developed, and a compact survey system which can analyze the data on the site has been realized. As aresult of the survey at city areas, all pipes buried less than 1m in depth with the resistivity value of more than 100 Ω m were detected as well as those less than 2m in depth with more than some 100 Ω m. However, non-metal pipes buried deeper than 1m in the ground of less than 100 Ω m were not detected. Consequently, improvement of the system is necessary in future. 7 refs., 23 figs., 6 tabs.

48674 (EPRI-EL–6965) **Field evaluation of grillage foundation uplift capacity: Final report.** Stewart, H.E. (Cornell Univ., Ithaca, NY (USA). Geotechnial Engineering Group); Kulhawy, F.H. Electric Power Research Inst., Palo Alto, CA (USA); Cornell Univ., Ithaca, NY (USA). Geotechnial Engineering Group. ©Aug 1990. 301p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

This study presents the results of eight full-scale field uplift tests on steel grillage foundations. The two field sites where the tests were conducted in New York State are described, along with the three grillage types found at these sites. Structural and construction details of the grillages are given. Soil characterization of the sites was conducted using a variety of in-situ test methods including the standard penetration, cone penetration, pressuremeter, borehole shear, drive cone, and dilatometer tests. Laboratory classification and strength tests also were performed to aid in the characterizations. The field testing equipment and the test procedures used for the uplift tests are described. The load-displacement results are given, as well as the ground movements in the zones above the grillages. The vertical shear model reported in EPRI EL-2870 is used to predict the uplift capacities, and comparisons are made with the field measurements. The vertical shear

model, coupled with well-documented geotechnical properties, can be used to predict accurately the uplift capacity of grillage foundations. For grillages in granular soils, the incorporation of side shearing resistance is important. The field test results indicated that, for D/B ratios from 1 to 3, roughly 55 to 80 percent of the uplift capacity is attributable to side resistance, with only 20 to 45 percent of the capacity resulting from soil weight. This result is important when deciding on the allowable loadings that may be imposed from upgradings and increased tower heights. The use of existing foundations may result in substantial cost savings over new foundations, provided that adequate subsurface exploration and geotechnical data are incorporated into the planning and design stages. 63 refs., 224 figs., 82 tabs.

48675 (LPC–90-04108) **Glossary of lineman: English French, French-English.** Lexicon Project Committee, Fredericton, NB (Canada). Jan 1990. 104p. (MICROLOG–90-04108). Source: PC New Brunswick Legislative Library, Government Documents Section, 766 King St, Fredericton, NB, CAN E3B 5H1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A bilingual (English-French, French-English) glossary is provided of terms used by linemen, intended to standardize terminology and to encourage its proper use. Both French and English listings are provided in alphabetical order. Synonyms are also given along with the main term. 58 refs.

48676 (OH/RD–89-252-K) **Atmospheric corrosion of transmission line conductors: Literature review.** Kalvins, A. Ontario Hydro, Toronto, ON (Canada). Research Div. 2 Nov 1989. 15p. (MICROLOG–90-03520). Source: PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

Transmission line conductors consist of strands of aluminum wound around a core of galvanized steel. Many atmospheric pollutants such as SO_2, NO_x and Cl in the presence of the proper meteorological conditions, high relative humidity, precipitation, fog or dew, etc., will cause significant rates of corrosion of aluminum and zinc (galvanized steel). The study of the corrosion of transmission line conductors is complicated by the direct contact of the aluminum and galvanized steel wires and the crevices formed as a result of the winding of the aluminum wires around the galvanized steel core. More information is needed about the effects of alkali, such as calcium hydroxide, on the atmospheric corrosion of these materials. The information presented in this review suggests that, at least initially, when trying to estimate the life of transmission line conductors, the local concentrations of pollutants such as sulfur dioxide, sulfate and chloride salts, the pH of precipitation and meteorological factors such as relative humidity and amount of precipitation, must be considered. 17 refs., 7 figs.

48677 (OH/RD–89-275-K) **The use of cover crops for the maintenance of rights-of-way vegetation: A survey of the literature on succession, cover crops competition and trees.** Brown, D. Ontario Hydro, Toronto, ON (Canada). Research Div. 27 Nov 1989. 46p. (MICROLOG–90-03530). Source: PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

A literature survey was undertaken to determine the current state of knowledge on the use of cover crops for the control of tree establishment and growth. In recent years, Ontario Hydro has attempted to integrate a biological control strategy within the rights-of-way maintenance program. The intent of this strategy is to utilize properties inherent within the vegetation to slow down or stop the natural successional development towards a forest. There is evidence in the literarure that the direction and rate of succession can be altered through the manipulation of the plant communities. The success of biological control is dependent upon two factors: the presence of species in the existing community which are able to interfere with tree growth, and that these species will spread on the right-of-way. This can be considered as a passive approach to the application of a biological control strategy, and the successful establishment of a vegetation capable of exerting a high degree of biological control has been very elusive using this passive approach. The alternative is the active approach called cover cropping, where the right-of-way is planted with a cover crop species or group of species which have a previously demonstrated the ability to interfere with tree growth. Although cover crops have been used extensively for revegetation, erosion control and land reclamation projects, there is little published information available which is specificaly related to vegetation control. The forestry and orchard industries have undertaken some research in cover crops. Additional research is required to identify potentially useful cover species and to determine the feasibility of such an approach for rights-of-way vegetation control. 91 refs., 1 fig., 10 tabs.

48678 (OH/RD–89-301-K) **Thermal instability of underground power cables.** Radhakrishna, H.S.; Lau, K.C. Ontario Hydro, Toronto, ON (Canada). Research Div. 13 Dec 1989. 21p. (MICROLOG–90-03998). Source: PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

Heat generated by underground power cables is dissipated through the surrounding soil. When this heat transfer process induces rapid thermal drying of the backfill soil causing the cable temperature to rise rapidly, the cable system is said to be thermally unstable. The mechanism of thermal instability is reviewed, and a rational basis for identifying the potential for thermal instability in various types of soils is proposed. The proposed identification system has been validated by the results of a parametric study using the TRUCHAM computer code and has been verified by a field experiment. It is shown that the thermal instability of a soil is a function of its thermal and hydraulic properties. The indices proposed to describe these properties include the thermal instability coefficient, the critical moisture limit, the critical moisture index, the thermal resistivity ratio, and the thermohydraulic coefficient. The results of the parametric study indicate that the stability of the soils decreases with the decrease in thermal instability coefficient and decrease in critical moisture index. The soil stability increases with an increase in the thermohydraulic coefficient. 16 refs., 9 figs., 1 tab.

2405 Environmental Aspects

Refer also to citation(s) 48151, 48677, 49730

48679 (MIC–90-03188/XAB) **Guidelines for an environmental impact assessment of the second New England intertie 345-kV transmission line.** New Brunswick Electric Power Commission, Fredericton, NB (Canada). ©1990. 26p. Source: NTIS, PC EE07/MF E01.

Text in English and French (Bilingual).

Guidelines for the New Brunswick Electric Power Commission (NB Power) relating to the substance, scope, and conduct of an environmental impact assessment (EIA) of a proposal by NB Power to construct and operate a 345 kV transmission line from the Point Lepreau Generating Station to the New Brunswick-State of Maine border. The guidelines cover the conduct of EIA and report preparation, description of the project and the existing environment, and the valued environmental components.

48680 (MIC–90-03189/XAB) **Guidelines for an environmental impact assessment of a 345-kV transmission line from Salisbury to Bathurst/Belledune.** New Brunswick Electric Power Commission, Fredericton, NB (Canada). ©1990. 24p. Source: NTIS, PC EE07/MF E01.

Text in English and French (Bilingual).

Document to provide guidance to the New Brunswick Electric Power Commission (NB Power) relating to the substance, scope, and conduct of an environmental impact assessment (EIA) of a proposal by NB Power to construct and operate a 345 kV transmission line from Salisbury to Bathurst/Belledune. The document covers the conduct of the EIA and report preparation, description of the project and the existing environment, and valued environmental components.

48681 (NBE–90-03188) **Guidelines for an environmental impact assessment of the second New England intertie 345 kV transmission line.** New Brunswick Dept. of the Environment, Fredericton, NB (Canada). Feb 1990. 26p. (MICROLOG–90-03188). Source: PC New Brunswick Legislative Library, Government Documents Section, 766 King St, Fredericton, NB, CAN E3B 5H1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This document provides guidance to the New Brunswick Electric Power Commission (NB Power) on the substance, scope, and conduct of an Environmental Impact Assessment (EIA) of a proposed 345 kV transmission line from the Point Lepreau Generating Station to the New Brunswick-State of Maine border to be constructed and operated by NB Power. The document covers the conduct of an EIA and the report preparation, including the methodological approach, the inclusion of public concerns, and the establishment of terms of reference. A description of the project and the existing environment is to be given in terms of its physical characteristics, land rights, construction activities and maintenance activities. Environmental components which should be considered in the EIA include impacts on existing land users and owners, human health and safety, wildlife and endangered species, the development of natural resources and agriculture in the area, and historical and archelogical resources. 1 fig., 1 ref.

48682 (NBE–90-03189) **Guidelines for an environmental impact assessment of a 345 kV transmission line from Salisbury to Bathurst/Belledune.** New Brunswick Dept. of the Environment, Fredericton, NB (Canada). Feb 1990. 24p. (MICROLOG–90-03189). Source: PC New Brunswick Legislative Library, Government Documents Section, 766 King St, Fredericton, NB, CAN E3B 5H1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This document provides guidance to the New Brunswick Electric Power Commission (NB Power) on the substance, scope and conduct of an Environmental Impact Assessment (EIA) of a proposal by NB Power to construct and operate a 345 kV transmission line from Salisbury to Bathurst/Belledune. The document covers the conduct of an EIA and the report preparation, including the methodological approach, the inclusion of public concerns, and the establishment of terms of reference. A description of the project and the existing environment is to be given in terms of its physical characteristics, land rights, construction activities and maintenance activities. Environmental components which should be considered in the EIA include impacts on: existing land users and owners, human health and safety, wildlife and endangered species, the development of natural resources and agriculture in the area, and historical and archeological resources. 1 fig., 1 ref.

2407 Economic, Industrial, and Business Aspects

Refer also to citation(s) 48181, 48752, 48754

48683 (CRIE-Y–90001) **Survey of utility real-time pricing programs in the U.S.** Asano, H. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Apr 1990. 47p. (In Japanese). Order Number DE91701404. Source: NTIS (US Sales Only), PC A03/MF A01.

Response to a rise interest in Real-Time Pricing (RTP) in and out the Japan, the background of introduction, the motive, assessment and issues of RTP in U.S. are examined. Utility objectives of RTP include the following: (1) for large industrial and commercial costomers to discourage resort to cogeneration or private power generation, and to encourage off-peak load growth; (2) for residential costomers to demonstrate the commercial viability of a communications/load control technology; (3) to generate costomer behavior data on price responsiveness and load adjustment. Costomers who have an energy management system or an energy storage system respond more to RTP than the others. Commercial sector enterprises such as a hospital and a frozen food distribution center, who seem to be rather difficult in load adjustment, show a comparatively flexible response. It is shown by Monte Carlo simulation that RTP which is adaptable to unpredictable fluctuations in demand is superior to seasonal and time base rate schedule in which the price is fixed in advance, even though the time zone is subdivided. 17 refs., 10 figs., 6 tabs.

25 ENERGY STORAGE

48684 (LBL–26455, pp. 191) **Surface morphology of metals in electrodeposition.** Tobias, C.W. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The objective of this project is to gain understanding of the partial processes and their interactions involved in the deposition and dissolution of metals by electrolysis. Of particular interest is the influence of hydrodynamic flow on electrocrystallization, and the distribution of charge-transfer rates on advancing and receding metal profiles, as determined by the electric and concentration fields in the solution, and by the kinetics of the charge-transfer reaction. Control of the morphology of metallic deposits has been traditionally effected by addition agents that interfere with the crystallization process. In energy-storage applications, however, other means may have to be employed for the control of morphology. Rotating-disk, rotating-cylinder, or planar electrodes in channel-type electrolyzers are used for the preparation of metal deposits on substrates with precisely defined surface topography. The genesis of surface textures is studied, using in situ motion-picture microphotography, videorecording, and post mortem examination by electron microscopy. Developing surface contours are simulated by solving the Laplace equation, using either the finite-difference, finite-element, or boundary-element method. The effects of transport of metal ions and additives by convective diffusion are concurrently evaluated.

2501 Magnetic

Refer also to citation(s) 48497

2502 Compressed and Liquefied Gas

48685 (CRIE-Y–90002) **Technical assessment and economic study of compressed air energy storage in Japan.** Uchiyama, Y.; Kadoyu, M. Central Research Inst. of Electric Power Industry, Tokyo (Japan). May 1990. 38p. (In Japanese). Order Number DE91701405. Source: NTIS (US Sales Only), PC A03/MF A01.

In order to clarify the technological feasibility of compressed air energy storage systems (CAES) in Japan, economical analyses and technical investigations of the storage systems were conducted. The difinition of efficiency of CAES was made clear and CAES was compared with other energy storage technologies, then followings were elucidated: the efficiency of CAES was inferior to that of the superconducting magnetic energy so far, but was superior to that of the pumped hydro; and may be improved up to that of the superconducting magnetic energy by technological progress in future. Storage facility of compressed air can be constructed by the existed technique on hard rock caverns. As to soft rock caverns and seabed storage tanks, there are subjects to be developed. Hard rock CAES system can compete on generating cos with the conventional pumped hydro and LNG combined cycle if the site conditions are acceptable, however in other system, the technical developments to improve the economy are required. Since the increasing ratio of the construction cost of CAES is lower in comparison with the pumped hydro which the construction cost increases with the site conditions, CAES is expectative system as substitute for the pumped hydro. 20 figs., 6 tabs.

2504 Capacitor Banks

48686 **A 4096 cell switched capacitor analog waveform storage integrated circuit.** Kleinfelder, S.A. (Lawrence Berkeley Lab., CA (USA). Physics Div.). *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(3): 1230-1236 (Jun 1990). DOE Contract AC03-76SF00098. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE)

nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

This paper reports a full custom switched capacitor transient analog waveform storage and reconstruction integrated circuit containing 4096 sample and hold cells designed, fabricated and tested. The switched capacitor array (SCA) is organized as 16 parallel channels of 256 serially addressed samples per channel with multiplexed and buffered analog output. Signal sampling frequencies of up to 100 MHz have been accomplished, with a dynamic range, measured at 10 MHz, of at least 8000 to 1.

2505 Flywheels

Refer also to citation(s) 49406

2506 Thermal

Refer also to citation(s) 48496

48687 (CEA-CONF-9684) **A 600 m^3 stratified thermal storage using sensible heat on the saclay nuclear research site (France).** Caizergues, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Dept. d'Etudes Mecaniques et Thermiques); Coche, J.C.; Coquille, J.P. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques. Oct 1988. 8p. (In French). (CONF-881013–6: JIGASTOCK '88: international conference on applied geothermal energy and thermal energy storage, Versailles (France), 18-21 Oct 1988). Order Number DE91701160. Source: NTIS (US Sales Only), PC A02/MF A01.

A heat recovery system for the thermal effluent (hot water at 35 C) from the OSIRIS nuclear reactor is described. It is composed of a 1.8 MW heat pump, a stratified hot water storage system (600 m^3) and a heat exchanger for the heat transfer to a building space heating system. The storage system is specially designed to prevent evaporation and convection in order to enhance stratification.

48688 (MIC–90-03390/XAB) **Report to Dept. of Supply and Services on the economics of cool storage for Bell Northern Research Lab 5, Ottawa, Ontario and a comparison of chilled water with three types of ice-storage modules.** Engineering Interface Ltd. (Canada). ©1989. 44p. Contract CANMET-89081-01-SQ. Source: NTIS, PC EE07/MF E01.

The escalating cost of new electric generation inspired investigation of methods for levelling demand and improving electric load factors. The outstanding candidate for load levelling is cool storage. With some electric utilities, mechanical cooling is responsible for over 50% of peak summer demand. Bell Northern Research Laboratories is a prime candidate for cool storage because cooling loads for computer room and process continue on a year round basis. This study examined the economics of cool storage and compared the viability of several types of cool storage hardware, including that which manufactured ice.

48689 (OH/RD–89-274-K) **Operational testing of two thermal energy storge furnaces.** Milligan, N.H. Ontario Hydro, Toronto, ON (Canada). Research Div. 10 Nov 1989. 13p. (MICROLOG–90-03522). Source: PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

Two thermal energy storage furnances were evaluated in the laboratory. One furnace used a low-density crushed rock as the storage medium; the other used high density ceramic brick. The furnaces were tested to determine stand-by heat loss, operating efficiencies, and safety. The crushed rock furnace performed reliably with stand-by losses ranging from 2.5 to 3.1 kW and an operating efficiency of 79%. The main deficiencies recorded during the tests were the operating storage capacity and heat output. The ceramic brick furnace had stand-by losses ranging from 2.5 to 3.1 kW and an operating efficiency of 70%. This furnace failed to operate satisfactorily due to the over-heating of a control panel that caused the surface temperature of the plenum to reach 117°C; this surface temperature represents a hazard. In conclusion, both the crushed rock and ceramic brick furnace require some additional development work to become a viable alternative for future energy management programs. 2 fig., 7 tabs.

48690 (PNL–7441) **Results from a workshop on research needs for modeling aquifer thermal energy storage systems.** Drost, M.K. Pacific Northwest Lab., Richland, WA (USA). Aug 1990. 13p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. (CONF-8911224–1: Workshop on aquifer thermal energy storage (ATES) modeling system, Seattle, WA (USA), 30 Nov - 1 dec 1989). Order Number DE90018007. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A workshop an aquifer thermal energy storage (ATES) system modeling was conducted in Seattle, Washington, on November 30 and December 1, 1989 by Pacific Northwest Laboratory (PNL). The goal of the workshop was to develop a list of high-priority research activities that would facilitate the commercial success of ATES. During the workshop, participants reviewed currently available modeling tools for ATES systems and produced a list of significant issues related to modeling ATES systems. Participants assigned a priority to each issue on the list by voting and developed a list of research needs for each of four high-priority research areas; the need for a feasibility study model, the need for engineering design models, the need for aquifer characterization, and the need for an economic model. The workshop participants concluded that ATES commercialization can be accelerated by aggressive development of ATES modeling tools and made specific recommendations for that development. 2 tabs.

2509 Batteries

Refer also to citation(s) 48468, 48755, 48838, 48839, 48840, 49098, 49100, 49101, 49102, 49103, 49104, 49107, 49108, 49109, 49110, 49111, 49112, 49113, 49114, 49115, 49116, 49117, 49118, 49119, 49120, 50234

48691 (AD-A–223097/7/XAB) **Evaluation of room-temperature chloroaluminate molten salts as electrolytes for high energy density batteries. Final report, June 1988-April 1990.** Vaughn, R.L. Frank J. Seiler Research Lab., United States Air Force Academy, CO (USA). Apr 1990. 33p. (FJSRL-TR–90-0001). Source: NTIS, PC A03/MF A01.

This report reviews past battery studies using room-temperature chloroaluminate electrolytes, pointing out problems experienced. The report then summarizes attempts to circumvent these problems. A cell is described that uses a sodium anode, a copper (II) chloride cathode, and room-temperature chloroaluminate electrolyte buffered to the neutral composition. Cells give an open circuit voltage greater than 2.75 volts and discharge near 1 milliAmperes per centimeters squared at voltages greater than 2 volts for more than 20 hours. Cell failure is attributed to the formation of a nonconductive coating on the sodium electrode. Suggestions for future studies are presented. While the room-temperature chloroaluminates appear suitable for high-voltage, low-current batteries, their physical properties may limit their potential for high energy density batteries.

48692 (LBL–26455, pp. 191-192) **Application of video microscopy to in situ studies of electrodeposition.** McVay, L.; Muller, R.H.; Tobias, C.W. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The development of the morphology of growing electrodeposits has not, until recently, received sufficient emphasis in electrochemical research. Video recording offers a great advantage over time-lapse photography, in that the quality of images can be immediately evaluated and suitable adjustments made, as opposed to waiting for developed motion picture film after the experiment is completed. The traveling videomicroscope built in their laboratories has several unique features that make it possible for them to study microscopic processes in situ in flow cells. Three-dimensional movement permits easy observation of any portion of the electrode surface. The traveling stage, capable of oscillatory movement, allows the simultaneous observation of extended electrode areas. In the authors system, they use retrofocusing lenses in applications

requiring the objective lens to be kept away from the specimen. These retrofocusing lenses have working distances up to 10 times that of a normal objective lens; thus they can be placed outside the electrochemical cell. The videomicroscope system is able to record the progress of deposition at magnifications up to 375X, corresponding to a video image of approximately 300 × 200 μm.

48693 (LBL–26455, pp. 195) **Surface layers on battery materials.** Muller, R.H. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The structure and composition of surface layers for rechargeable galvanic cells are determined in order to identify film-formation mechanisms and to find means to control film properties that result in high power density, cycle life, and energy efficiency. Anodic oxide formation and cathodic metal deposition of interest for battery applications in aqueous media are presently investigated. Experimental measurements are centered on in situ optical techniques: elastic light scattering and Raman spectroscopy have recently been added to spectroscopic ellipsometry and video microscopy for the determination of structure and composition of surface layers, as has scanning tunneling microscopy. Electrochemical and ex situ techniques of surface analysis continue to be used. Experimental results are employed in theoretical models for the quantitative description of the formation of surface layers. Studies on the effect of adsorbed materials on the electrocrystallition of metals and the exploration of new means to accelerate electrochemical mass transfer for high-rate metal deposition are reported under Electrochemical Phase Boundaries.

48694 (LBL–26455, pp. 195) **In situ laser Raman spectroscopy of copper anodization in alkaline media.** Mayer, S.T.; Muller, R.H. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Anodic surface films formed on copper in 1M KOH were studied, using new Raman spectroscopy equipment. During a potential sweep, Cu_2O (633 cm^{-1}) was observed to form at the potentials of the first current peak (– 350 mV vs Hg/HgO). Near the second current peak (0 mV), $Cu(OH)_2$ (488 cm^{-1}) was observed to form, although CuO is thermodynamically more stable than the hydroxide. The Cu_2O peak disappears only gradually as $Cu(OH)_2$ is formed. Near the anodic potential of oxygen evolution (650 mV), a broad Raman band around 550 cm^{-1} has been observed and is proposed to result from the presence of a trivalent copper surface species. The mechanism of reduction of the different oxide species to copper metal is complex and is affected by illumination.

48695 (LBL–26455, pp. 196) **In situ scanning tunneling microscopy of Pb multilayer deposits on Ag.** Mayer, S.T.; Muller, R.H.; Ross, P.N. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The multilayer electrodeposition of Pb on evaporated polycrystalline Ag was studied using new in situ scanning tunneling microscopy (STM) equipment. At the onset of bulk deposition, a large number of small (50-100 Å) growth centers are seen to form at the rougher portions of the substrate. The growth of these centers results in a reduction of the short-range roughness and a longer-range (500 Å) waviness of the surface develops. Another roughening cycle is initiated by renewed nucleation. Amplitude density and autocorrelation functions of surface profiles have been used for the quantitative analyses of STM images. Such functions are shown for the substrate and the four surfaces. The successive changes in the width of the distributions illustrate the repeated roughening and smoothing cycles ascribed to nucleation and growth in recessed regions of the surface.

48696 (LBL–26455, pp. 196) **Structural changes of oxide films during anodization of p-doped silicon in aqueous ammonium fluoride.** Crocker, R.W.; Muller, R.H. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The growth of anodic oxide layers on silicon in 0.1M NH_4F, pH 3.5, was measured by spectroscopic ellipsometry during the application of potential steps. The film grows to a steady-state thickness that increases with increasing potential, for a series of potential steps of approximately 5 min duration, separated by open-circuit periods of approximately 10 min. Surprisingly, the film does not dissolve at open circuit. Current oscillations observed above 3.0 V are therefore not caused by dissolution-limited film growth, and other models are being investigated to explain this phenomenon.

2510 Economic, Industrial, and Business Aspects

Refer also to citation(s) 48688

2530 Environmental Aspects

Refer also to citation(s) 48838

29 ENERGY PLANNING AND POLICY

2901 Energy Analysis and Modeling

Refer also to citation(s) 48690

48697 (IFP–37748-1) **Modelization of the energy demand. Application to the OECD countries.** Huitric, R. Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison (France); Dijon Univ., 21 (France); Ecole Nationale Superieure du Petrole et des Moteurs (ENSPM), 92 - Rueil-Malmaison (France). Nov 1989. 365p. (In French). Order Number DE91701169. Source: NTIS (US Sales Only), PC A16/MF A01.

Within the frame of the seven main OECD countries, an energy demand model has been developed; the model is detailed by energy sources and by consumption sectors. It takes into account the international energy markets and all the energy sources; it integrates the supply and demand interactions and the technologies developments associated with energy production and utilization. The model is validated with various examples.

2902 Economics and Sociology

Refer also to citation(s) 48139, 48143, 48255, 48652, 48739, 48793, 48803, 49569, 49739

48698 (CERI–90-01036, pp. 1-22, Paper 7) **Outlook for demand growth in Asian countries.** Kumar, L. Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

This paper considers the outlook in the demand for hydrocarbons (oil and natural gas) in Asia, defined as the countries south of the Soviet Union but excluding countries like Iran and the industralized countries of the Pacific (Australia, New Zealand and Japan). The demand for primary energy and hydrocarbons for the production of chemicals is treated separately. Accurate data on past and present consumption of primary commercial and non-commercial energy are not readily available and such data as is provided by various agencies (UN, IEA, ESCAP and WEC) show a number of inconsistencies and omissions, exclude animal draft power, and underestimate, often seriously, the consumption of non-commercial energy sources such as fuel wood, and crop and animal wastes which play a significant part in the energy balance. The main features in the outlook for energy demand and the share of hydrocarbons include a decline in energy demand in industry and transportation; increasing energy demand in agriculture; increasing commercial energy consumption by the poor; and an increasing concern that the large consumption of non-commercial fuels has led to severe erosion and degradation of the land. A summary of

the projected energy demands made by various sources is given, including those by India, Pakistan and Indonesia. First estimates are given for the demand for chemicals and feedstocks, particularly for nitrogenous fertilizers, which are expected to increase. 15 tabs.

48699 (CONF-9004177–3) **Artificial intelligence for subject interviewing.** Tonn, B.E.; Goeltz, R.; Arrowood, L.; Hake, K. Oak Ridge National Lab., TN (USA). [1990]. 16p. Sponsored by U.S. Department of Commerce; U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Advanced computing for the social sciences conference; Williamsburg, VA (USA); 10-12 Apr 1990. Order Number DE90017328. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper has two goals: to discuss, in general terms, issues related to applying artificial intelligence (AI) techniques to computerized interviewing; and to describe two AI-based interviewing systems developed at Oak Ridge National Laboratory. With respect to the former, AI techniques can be used effectively to collect data of complex representation, provide flexibility in collecting data, and improve data validity through real-time reviews. One AI system, ARK, elicits subjects' beliefs on an open-ended range of issues and topics through menu-driven, dialogue-based interactions. The other system, LES, elicits, uncertainty assessments related to events, statements and propositions and tailors questions for subjects to explore their uncertainty processing heuristics.

48700 (PB–90-254145/XAB) **Energy use and the US economy. Background paper.** Office of Technology Assessment (U.S. Congress), Washington, DC (USA). Jun 1990. 75p. (OTA-BP-E–57). Source: NTIS, PC A04/MF A01.

Also available from Supt. of Docs.

The background paper on the energy-economy link provides analysis of the 1972 to 1985 period when U.S. energy use remained level, but at the same time the economy grew by 40%. This was a sharp departure from post World War II trends when growth in the two factors appeared to be in lock step. The report identifies the causes for this apparent separation of energy use from economic growth, and aims to provide a more comprehensive understanding of the relationship between the two. The background paper also evaluates the more recent past, specifically the 8% overall increase in energy use registered between 1985 and 1988. This resurgence in energy use is partially due to a shift in the structure of the U.S. economy back towards more energy intensive industries such as steel and aluminum. Some of the increase in energy use is the result of a rise in exports and a decline in the growth rate of imports. This phenomenon creates a dilemma for policymakers who want a strong manufacturing sector and a reduced trade deficit, but also want to avoid some of the consequences associated with increased energy use.

48701 (UCRL-CR–104383) **Public attitudes toward Lawrence Livermore National Laboratory: Summary of findings.** Lawrence Livermore National Lab., CA (USA); Charlton Research Co., San Francisco, CA (USA). May 1990. 324p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90016407. Source: NTIS, PC A14/MF A01 - OSTI; GPO Dep.

Charlton Research Company is pleased to present the following summary of findings report for research conducted under contract with Lawrence Livermore National Laboratory. This section provides a brief introduction to the specifications of the study, and a guide to the organization of this report. Although the most sophisticated procedures have been used to collect and analyze the information presented here, it must be remembered that qualitative and quantitative research are not predictions. They are designed to measure public opinion within identifiable statistical limits or accuracy at specific points in time. This research is in no way a prediction of opinion or action at any future point in time. Among the topics covered in the surveys are: openness; National Laboratory; health hazards; radioactivity; uses of plutonium; hazardous waste; groundwater pollution; nuclear weapons; Ballistic Missile Defense; and earthquakes.

2903 Environment, Health, and Safety

Refer also to citation(s) 48097, 48122, 48150, 48157, 48159, 48260, 48263, 48268, 48442, 48744, 48774, 48775, 48776, 48777, 48778, 48833, 49418, 49419, 49422, 49424, 49426, 49428, 49429, 49434, 49435, 49436, 49437, 49438, 49439, 49441, 49443, 49444, 49445, 49446, 49447, 49448, 49449, 49450, 49451, 49452, 49453, 49454, 49474, 49475, 49476, 49477, 49478, 49479, 49480, 49481, 49482, 49483, 49484, 49485, 49486, 49487, 49488, 49489, 49490, 49491, 49492, 49493, 49494, 49495, 49496, 49497, 49498, 49499, 49500, 49501, 49502, 49503, 49504, 49505, 49506, 49507, 49508, 49509, 49510, 49511, 49512, 49513, 49514, 49515, 49516, 49517, 49518, 49519, 49520, 49521, 49522, 49523, 49524, 49525, 49526, 49527, 49528, 49529, 49530, 49540, 49543, 49570, 49577, 49578, 49579, 49580, 49581, 49600, 49601, 49606, 49607, 49608, 49609, 49612, 50063

48702 (CRIE-U–89015) **Current status of forest decline and its research activities in Europe.** Nashimoto, M.; Kono, Y. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Nov 1989. 43p. (In Japanese). Order Number DE91701408. Source: NTIS (US Sales Only), PC A03/MF A01.

In order to elucidate the cause of forest decline in Europe, the review and investigation of existing material and the examination of research efforts, were conducted. The first signs of decline were reported in the beginning of 1970 ′ s for Silver fir stands in west Germany, and was followed by a decline of Norway spruce in the early 1980 ′ s. The damage ranges over pine, beech and oak at present. Characterstic symptoms are found due to species, decline varies greatly among sites and the period to a heavy damage becomes shorter. Major hypotheses for the causes are as follows: soil acidification; ozone damage (ozone only, or ozone + acid mist, or acid fog); and excess nitrogen deposition. Combined causes with several factors are considerd, specially the effects of air pollutant are regarded as important. The studies on the effects of air pollutant are divided into following experimental approaches: field observations and tests; open top chamber experiments (to absorb the actual atmosphere and to absorb the filtered atmosphere); and indoor chamber experiments. 88 refs., 9 figs., 6 tabs.

48703 (MIC–90-03097/XAB) **Organizational and spatial frameworks for state of the environment reporting.** Sheehy, G. Canadian Wildlife Service, Ottawa, ON (Canada). ©1989. 92p. Source: NTIS, PC EE07/MF E01.

Text in English and French (Bilingual). French ed. on the same fiche.

State of the Environment (SOE) reporting is designed to provide high quality, comprehensive assessments of environmental conditions and trends. This report compares alternative organizational and spatial reporting frameworks, and analyzes their strengths and weaknesses as a basis for guiding resource managers preparing SOE reports. The report also explains how different authors and different countries have approached the complex task of reporting conditions and trends in their environment, and explains the utility and value of SOE methods.

48704 (MIC–90-03118/XAB) **Environmental data bases for State of the Environment reporting: Conservation and Protection Headquarters. Technical Report Series No. 9.** Keddy, C.J.; McRae, T. Canadian Wildlife Service, Ottawa, ON (Canada). ©1989. 180p. Source: NTIS, PC EE12/MF E01.

In December 1988, the State of the Environment (SOE) reporting branch began an inventory of Environment Canada databases of potential use to such reporting. The inventory represents an initial step towards the development of an SOE information system (database referral component) to be established by Statistics Canada. This report summarizes the inventory results for Conservation and Protection headquarters by identifying SOE related databases held in that responsibility centre. Database inventories are indexed by framework category and by responsibility centre.

48705 (OCS/EIS/EA/MMS–90-0042-Vol.1) **Gulf of Mexico Sales 131, 135, and 137: Central, western and eastern planning areas: Final environmental impact statement: Volume 1, Sections I through IV.C.** Minerals Management Service, New Orleans, LA (USA). Gulf of Mexico OCS Regional Office. Aug 1990. 390p.

Sponsored by U.S. Department of the Interior. Source: OSTI; US Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, 1201 Elmwood Park Blvd., New Orleans, LA 70123-2394.

This environmental impact statement (EIS) addresses three proposed federal actions that will offer for lease areas on the Gulf of Mexico Outer Continental Shelf (OCS) that may contain economically recoverable oil and gas resources. The three proposed sales are part of the Department of the Interior's (DOI's) current 5-Year program, which covers the period from mid-1987 to mid-1992. The proposed sales are scheduled to occur in 1991 and include lease blocks in the Central, Western, and Eastern Gulf of Mexico. Nearly 20,000 blocks will be available for lease under the three proposed actions, but only a small percentage are expected to actually be leased. The average number of blocks leased in individual Gulf of Mexico OCS lease sales since 1984 have been 431 (7 sales) in the Central Gulf, 279 (6 sales) in the Western Gulf, and 108 (3 sales) in the Eastern Gulf. Of the blocks that will actually be leased as a result of the three proposed actions, only a portion will eventually have drilling plans filed with the Minerals Management Service (MMS). When a drilling plan is proposed, MMS conducts a site-specific environmental assessment of the affects of the proposed activity. This paper presents brief descriptions of the proposed actions, alternative, mitigating measures, and issues addressed in this EIS. 33 figs., 61 tabs.

48706 (PB–90-249491/XAB) **Superfund: Looking back, looking ahead.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. Dec 1987. 26p. (EPA–9200.5-001). Source: NTIS, PC A03/MF A01.

The article provides an overview of the Superfund hazardous wastes cleanup process and key aspects of the Superfund Amendments and Reauthorization Act of 1986 (SARA). The document also addresses the quest for alternative technologies; emergency planning and community right-to-know; the Leaking Underground Storage Tank Trust Fund (LUST); State involvement; and challenges for Superfund for the future.

48707 (PB–90-249541/XAB) **Superfund analytical review and oversight. Directive (Final).** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 18 Oct 1988. 7p. (EPA–9240.0-03). Source: NTIS, PC A02/MF A01.

The directive outlines procedures and responsibilities related to review and oversight of Superfund analytical data.

48708 (PB–90-249624/XAB) **CERCLA off-site policy: Providing notice to facilities. Final report.** Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste and Emergency Response. 12 May 1986. 8p. (OSWER DIRECTIVE–9330.2-05). Source: NTIS, PC A02/MF A01.

The directive assists in providing notice to commercial treatment, storage, and disposal (TSDs) facilities deemed ineligible to receive CERCLA response wastes. Outlines procedures for facilities to submit written comments on the application of the policy to the conditions alleged at their facility.

48709 (PB–90-249657/XAB) **RI/FS improvements follow-up. Final report.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 25 Apr 1988. 18p. (EPA–9355.3-05). Source: NTIS, PC A03/MF A01.

The reports directive delineates improvements developed for more effective Remedial Investigations/Feasibility Studies (RI/FS).

48710 (PB–90-249681/XAB) **Results of FY '89 record of decision analysis Superfund management review implementation product. Recommendation No. 25A. Directive (Final).** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 30 Mar 1990. 20p. (EPA–9355.3-09). Source: NTIS, PC A03/MF A01.

The directive provides an analysis of FY '89 Records of Decision (RODs) conducted by the Office of Emergency and Remedial Response (OERR) and the Office of Waste Programs Enforcement (OWPE). The directive focuses on the consistency of remedy selection decisions with Superfund program expectations as established in the National Contingency Plan (NCP), and the quality of ROD documentation. The report highlights improvements in ROD quality and discusses trends over the past several years. The report also offers recommendations for strengthening RODs in the future.

48711 (PB–90-249731/XAB) **Involvement of Superfund program managers in Superfund response agreement audits. Directive (Final).** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 12 Feb 1990. 20p. (EPA–9375.5-04). Source: NTIS, PC A03/MF A01.

The directive provides general reference information to Superfund program managers about the audit process. The information in the Directive pertains primarily to audits of Cooperative Agreements, but may be applied to audits of Superfund State Contracts (SSCs).

48712 (PB–90-249756/XAB) **Superfund innovative technology evaluation program: Technology profiles, November 1989.** PRC Environmental Management, Inc., McLean, VA (USA). Nov 1989. 129p. Contract EPA-68-03-3484. Source: NTIS, PC A07/MF A01.

See also report for 1988, PB–90-132690.

The document profiles fifty-two demonstration and emerging technologies being evaluated under the SITE program. Each technology profile contains a description of the technology; a discussion of its applicability to various wastes; and update on its development or demonstration status; and any available demonstration results. The document is intended for EPA regional decision-makers and other interested individuals involved in hazardous waste site cleanups.

48713 (PB–90-249772/XAB) **Guide for conducting treatability studies under CERCLA. Interim report (Final).** PEI Associates, Inc., Cincinnati, OH (USA). Dec 1989. 134p. Contract EPA-68-03-3413. Source: NTIS, PC A07/MF A01.

The guide describes an approach for conducting treatability studies that consists of laboratory screening, bench-scale testing, and pilot-scale testing. The guide also presents a stepwise approach or protocol for conducting treatability studies for determination of the effectiveness of a technology (or combination of technologies) in remediating a CERCLA site.

48714 (PB–90-502618/XAB) **Site Enforcement Tracking System (SETS) (Region 1) (for microcomputers). Data file.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. Aug 1990. vp. Source: NTISCP D01.

System: IBM PC/AT; MS DOS 3.3 operating system, 640K.; The datafile is contained on two 1.2M, 5 1/4 inch diskettes, high density. File format: ASCII.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). This data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created by EPA to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists represent EPA's preliminary findings on the identities of PRPs. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. Region 1 includes Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

48715 (PB–90-502626/XAB) **Site Enforcement Tracking System (SETS) (Region 2) (for microcomputers). Data file.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. Aug 1990. vp. Source: NTISCP D01.

System: IBM PC/AT; MS DOS 3.3 operating system, 640K.; The datafile is contained on one 1.2M, 5 1/4 inch diskette, high density. File format: ASCII.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act)

site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). This data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created by EPA to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists represent EPA's preliminary findings on the identities of PRPs. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. Region 2 includes New Jersey, New York, Puerto Rico, and the Virgin Islands.

48716 (PB–90-502634/XAB) **Site Enforcement Tracking System (SETS) (Region 3) (for microcomputers). Data file.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. Aug 1990. vp. Source: NTISCP D01.

System: IBM PC/AT; MS DOS 3.3 operating system, 640K.; The datafile is contained on one 1.2M, 5 1/4 inch diskette, high density. File format: ASCII.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). This data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created by EPA to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists represent EPA's preliminary findings on the identities of PRPs. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. Region 3 includes Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia.

48717 (PB–90-502642/XAB) **Site Enforcement Tracking System (SETS) (Region 4) (for microcomputers). Data file.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. Aug 1990. vp. Source: NTISCP D01.

System: IBM PC/AT; MS DOS 3.3 operating system, 640K.; The datafile is contained on one 1.2M, 5 1/4 inch diskette, high density. File format: ASCII.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). This data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created by EPA to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists represent EPA's preliminary findings on the identities of PRPs. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. Region 4 includes Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee.

48718 (PB–90-502659/XAB) **Site Enforcement Tracking System (SETS) (Region 5) (for microcomputers). Data file.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. Aug 1990. vp. Source: NTISCP D01.

System: IBM PC/AT; MS DOS 3.3 operating system, 640K.; The datafile is contained on two 1.2M, 5 1/4 inch diskettes, high density. File format: ASCII.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). This data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created by EPA to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists represent EPA's preliminary findings on the identities of PRPs. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. Region 5 includes Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin.

48719 (PB–90-502667/XAB) **Site Enforcement Tracking System (SETs) (Region 6) (for microcomputers). Data file.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. Aug 1990. vp. Source: NTISCP D01.

System: IBM PC/AT; MS DOS 3.3 operating system, 640K.; The datafile is contained on one 1.2M, 5 1/4 inch diskette, high density. File format: ASCII.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). This data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created by EPA to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists represent EPA's preliminary findings on the identities of PRPs. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. Region 6 includes Arkansas, Louisiana, New Mexico, Oklahoma, and Texas.

48720 (PB–90-502675/XAB) **Site Enforcement Tracking System (SETs) (Region 7) (for microcomputers). Data file.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 31 Jul 1990. vp. Source: NTISCP D01.

System: IBM PC/AT; MS DOS 3.3 operating system, 640K.; The datafile is contained on one 1.2M, 5 1/4 inch diskette, high density. File format: ASCII.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). This data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created by EPA to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists represent EPA's preliminary findings on the identities of PRPs. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. Region 7 includes Iowa, Kansas, Missouri, and Nebraska.

48721 (PB–90-502683/XAB) **Site Enforcement Tracking System (SETs) (Region 8) (for microcomputers). Data file.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 31 Jul 1990. vp. Source: NTISCP D01.

System: IBM PC/AT; MS DOS 3.3 operating system, 640K.; The datafile is contained on one 1.2M, 5 1/4 inch diskette, high density. File format: ASCII.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). This data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created by EPA to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists represent EPA's preliminary findings on the identities of PRPs. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. Region 8 includes Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming.

48722 (PB–90-502691/XAB) **Site Enforcement Tracking System (SETs) (Region 9) (for microcomputers). Data file.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. Aug 1990. vp. Source: NTISCP D01.

System: IBM PC/AT; MS DOS 3.3 operating system, 640K.; The datafile is contained on one 1.2M, 5 1/4 inch diskette, high density. File format: ASCII.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). This data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created by EPA to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists represent EPA's preliminary findings on the identities of PRPs. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. Region 9 includes American Somoa, Arizona, California, Guam, Hawaii, Midway, Nevada, Northern Marianas, Pacific Islands, Trust Territories, and Wake Island.

48723 (PB–90-502709/XAB) **Site Enforcement Tracking System (SETts) (Region 10) (for microcomputers). Data file.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 31 Jul 1990. vp. Source: NTISCP D01.

System: IBM PC/AT; MS DOS 3.3 operating system, 640K.; The datafile is contained on one 1.2M, 5 1/4 inch diskette, high density. File format: ASCII.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). This data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created by EPA to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists represent EPA's preliminary findings on the identities of PRPs. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site. Region 10 includes Alaska, Idaho, Oregon, and Washington.

48724 (PB–90-591780/XAB) **Site Enforcement Tracking System (SETs) (National) (for microcomputers). Data file.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 31 Jul 1990. vp. Source: NTISSubscription.

System: IBM PC/AT; MS DOS 3.3 operating system, 640K. For system on magnetic tape, see PB–90-591790. The datafile is contained on twelve 1.2M, 5 1/4 inch diskettes, high density. File format: ASCII. Available on subscription, U.S., Canada and Mexico price $920.00/year; price for others $1840.00/year. Also available on demand as PB–90-591781 for D05. Issued quarterly.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). This data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created by EPA to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists represent EPA's preliminary findings on the identities of PRPs. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site.

48725 (PB–90-591790/XAB) **Site enforcement tracking system (SETS) (national). Data file.** Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement. 31 Jul 1990. mag ta Source: NTISSubscription.

System: IBM 3090; ESA 3.1.3 operating system. For system on diskette, see PB90-591780.; Available in 9-track EBCDIC character set, 1600 bpi. Available on subscription, U.S., Canada and Mexico price $880.00/year; all others $1760.00/year. Also available on demand as PB–90-591791, price T02 for either 1600 or 6250 bpi. Issued quarterly.

When expending Superfund monies at a CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) site, EPA must conduct a search to identify parties with potential financial responsibility for remediation of uncontrolled hazardous waste sites. EPA regional Superfund Waste Management Staff issue a notice letter to the potentially responsible party (PRP). Data from this notice letter is used to form the Site Enforcement Tracking System (SETS). This data includes PRP name and address, a company contact person, the date the notice was issued, and the related CERCLA site name and identification number. SETS was created by EPA to track PRP identification at both NPL (National Priority List) and non-NPL sites. SETS does not address the range of other administrative duties related to tracking the PRP. These lists represent EPA's preliminary findings on the identities of PRPs. Inclusion on these lists does not constitute a final determination concerning the liability of any party for the hazard or contamination at any CERCLA site.

48726 (SAND–90-1008C) **Development and test case application of a waste minimization project evaluation method.** Kjeldgaard, E.A. (Sandia National Labs., Albuquerque, NM (USA)); Saloio, J.H.; Varnado, G.B. Sandia National Labs., Albuquerque, NM (USA). [1990]. 8p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract AC04-76DP00789. (CONF-9010166–2: 6. annual Department of Energy model conference on waste management and environmental restoration, Oak Ridge, TN (USA), 29 Oct - 2 nov 1990). Order Number DE91000021. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper describes a formal process for selecting, from a diverse set of proposed waste minimization activities, those activities that provide the greatest benefit to Department of Energy (DOE). A methodology for evaluating and prioritizing proposals was developed to illustrate how the selection process works and what types of data are required to characterize waste minimization activities. It is clearly impossible to remove all aspects of subjective judgment from the proposal selection process. With this important consideration in mind, the methodology presented is put forth to enhance, not replace, the traditional DOE decision-making process. 5 refs., 2 figs., 1 tab.

2904 Energy Resources

Refer also to citation(s) 48170, 48705, 48739, 48750, 48833, 49569, 49737

48727 (EUR–11382, pp. 54-62) **The LEBEN - Project (Greece): Regional energy plan for Evrytania.** Kyritsis, S. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. (CONF-8710518–: Pyrolysis as a basic technology for large agro-energy projects workshop, L'Aquila (Italy), 15-16 Oct 1987). In *Pyrolysis as a basic technology for large agro-energy projects*. Source: OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 17.50.

Energy planning in Greece is a concern of the State. Planning decisions are taken by state authorities, or multi-institution work teams representing the authorities concerned. Decision making is done on the basis of a variety of considerations, ranging from pure economic to strictly social expected effects. In most cases planning is done with a view to achieving as multiple a set of goals as possible. Given the current international economic situation, it can be safely assumed, that energy planning aims at the reduction of fuel imports, the promotion of endogenous renewable sources, the improvement of efficiency rates of existing energy using equipment, and the development of domestic high-technology energy research and development centers or industries. Moreover, domestic economic situation also guides up to a great extent the long term economic, and social targets of state energy planning, like growth, industrialization, price level stability, balance of payment equilibrium, real income increase, reduction of unemployment, and also short-term projects, like infrastructure improvement, health and education modernization, housing and other similar policies. Such projects are usually incorporated into, and form the guidelines of integrated energy projects.

48728 (SEM–90-03451) **Saskatchewan Energy and Mines annual report, 1988-89.** Saskatchewan Dept. of Energy and Mines, Regina, SK (Canada). 1989. 32p. (MICROLOG–90-03451). Source: PC Saskatchewan Energy and Mines, 1914 Hamilton St., Regina, Sask., CAN S4P 4V4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

This report summarizes the activities and policies of the Saskatchewan Energy and Mines and its divisions of Finance and Administration, Resource Policy and Economics, Geology and Mines, and Petroleum and Natural Gas. Policy objectives of the divisions are described and include research and analysis of policy issues related to energy and resource development, promotion of exploration and development activities in the petroleum and mineral sectors, disposition and management of provincial oil and gas rights, well licensing, surveillance of oil and gas industry operations, oil and gas conservation, maintenance of statistics on reserves, production, and disposition of oil and gas, crude oil marketing, and royalty and tax legislation. Production and financial statistics are included where applicable, and publications of the particular sections, if any, are listed. Highlights of the year include a major expansion of the natural gas industry, a major review of coal royalties and taxes, the signing of an agreement for a horizontal well project in a heavy oil pool, and startup of the Regina heavy oil upgrader. 18 figs.

2905 Research, Development, Demonstration, and Commercialization

Refer also to citation(s) 48145, 48177, 48178, 48460, 48473, 48646, 48737, 48747, 48766, 48783, 48807, 48808, 48809, 48828, 48829, 48845, 49222, 49738

48729 (ANL–89/29) **Nuclear Technology Programs semiannual progress report, October 1987–March 1988.** Harmon, J.E. (ed.). Argonne National Lab., IL (USA). Aug 1990. 155p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. Order Number DE90018032. Source: NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.

This document reports on the work done by the Nuclear Technology Programs of the Chemical Technology Division, Argonne National Laboratory, in the period October 1987–March 1988. Work in applied physical chemistry included investigations into the processes that control the release and transport of fission products under accident-like conditions, the thermophysical properties of metal fuel and blanket materials of the Integral Fast Reactor, and the properties of selected materials in environments simulating those of fusion energy systems. In the area of separation science and technology, the bulk of the effort is concerned with developing and implementing processes for the removal and concentration of actinides from waste streams contaminated by transuranic elements. Another effort is concerned with examining the feasibility of substituting low-enriched for high-enriched uranium in the production of fission product ^{99}Mo. In the area of waste management, investigations are underway on the performance of materials in projected nuclear repository conditions to provide input to the licensing of the nation's high-level waste repositories.

48730 (NEDO-P–8951) **Co-researches with researchers of alternative energy of petroleum in EC countries.** New Energy Development Organization, Tokyo (Japan). Mar 1990. 110p. (In Japanese). Order Number DE91701466. Source: NTIS (US Sales Only), PC A06/MF A01.

Here are the results of information exchanges and co-researches with researchers of alternative energy of petroleum in EC countries. In the research on gas turbine parts applying the explosion shock sintering process, a solid compound was synthesized from the mixed fine particles of Ti and B at 10GPa. In coal liquefaction, solid and liquid were economically separated with a candle filter. In the coal liquefaction plant in Bergbau Forshung, it became possible to predict hydrobehaviors, and a pilot plant of 200 tons/day is being operated in Bottrop. Circumstances of 1 ton/day PSU of NEDOL liquefaction, universities and national laboratories are also explained in this report. In the research on functional materials, high molecular and electrolyte thick aqueous solution of cellulose system formed nematic liquid crystals. Research results on the InGaAs type high electron mobility transistor are explained, too. In fused carbonate fuel cells, dissolution, diffusion and re-precipitation of the cathode material NiO cause problems; and as a measure against these problems, thermodynamic fundamental researches were carried out. 14 refs., 53 figs., 8 tabs.

48731 (NEDO-P–8952) **Invitation business of experts in alternative energy.** New Energy Development Organization, Tokyo (Japan). Mar 1990. 57p. (In Japanese). Order Number DE91701467. Source: NTIS (US Sales Only), PC A04/MF A01.

Experts in alternative energy of EC were invited to visit Japanese enterprises and to hold seminars. In Japan, usually centralized researches are carried out with the governmental financing, and the research results are commercialized by private enterprises. Na/s cells and ceramic blades draw attentions at present. AMTE (Alkali Metal Thermo-Electric Converter) is a direct conversion unit of heat to energy with 40 - 48% high efficiency. As it has no moving parts, it fits for military use. In Japan, cooling in summer (mainly air conditioning with gas) is a research subject, and in Europe heating in winter (compression heat pump in France) is a subject. Researches on hydrogen are being carried out because of environmental issues. As new materials, development of ceramics and super alloys is being pushed forward. The development level of fuel cells in Japan is as high as that in Europe and in the USA, but the development in Japan is large-scaled and competitive because

public and private circles are co-operating for the commercialization of fuel cells. Solar cells are made more effective, more reliable and lower in costs. Development projects with the financing of the Japanese government are Sunshine Project and Moonlight Project, and researches are mainly made on coal. 5 figs.

48732 (NEDO-P–8953) **Interchange of researchers on alternative energy of petroleum in EC countries.** New Energy Development Organization, Tokyo (Japan). Mar 1990. 26p. (In Japanese). Order Number DE91701468. Source: NTIS (US Sales Only), PC A03/MF A01.

Researchers on alternative energy of petroleum in EC countries were invited and informations were exchanged between the researchers and research organizations in Japan. Geothermal power generation in Japan is 250MW. In the Hijiori high temperature rock project, the depth of the well is about 2km, and the temperature at the bottom of the well is more than 250 ° C; and press fit and circulation experiments of water are being carried out. In this project development of a heat resisting packer is a subject to reform channels for the improvement of recovery percentage. In the Tohoku University's project in Higashi Hachimantai, design research on artificial cracks for heat extraction is being pushed forward. While geothermal resources in Japan is of high temperature (more than 200 ° C), those in Europe are deeper in the underground and of low temperature (less than 200 ° C), and mutual and close technical co-operations between Japan and European countries are hoped for. In the research on the amorphous semiconductors for photovoltaic power generation, importance is put on the efficiency and the development of crystallization method. Researches are also made on the solar cells of hetero structure with high capacity of light gathering, the SiC electron emission elements, and the large-area cells of high efficiency. The growth mechanism of multicrystal semiconductors has been studied. Multilayer structures have been deposited. And concerning the efficiency, factors which limit cell performances have been clarified.

48733 (OE/RT–90-03626-Vol.2) **Proceedings [of the] Environmental research: Technology transfer conference: Volume 2. Liquid and solid waste, analytical methods, environmental socio-economics.** Ontario Ministry of the Environment, Toronto, ON (Canada). Research and Technology Branch. 1989. 504p. (CONF-8911230–: Environmental research: technology transfer conference, Toronto (Canada), 20-21 Nov 1989; MICROLOG–90-03625). Source: PC Publications Ontario, 880 Bay St, 5th Floor, Toronto, ON, CAN M7A 1N8; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $6.00 CAN; MF $10 CAN.

A technology transfer conference was held to report and publicize the progress made on ministry funded projects. Papers were presented in the areas of liquid and solid waste research, analytical methods and environmental socio-economics. Separate abstracts have been prepared for 4 papers from volume 2 of this conference.

48734 (RRTAC–88-6) **Alberta reclamation research annual report, 1987.** Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1987. 75p. (MICROLOG–89-02659). Source: PC Alberta Heritage Scholarship Fund Alberta, Reclamation Research, Technical Advisory Committee, 2nd floor, Pacific Plaza, 10909 Jasper Ave., Edmonton, AB, CAN T5J 3M8; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

The regulation of surface disturbances in Alberta is the responsibility of the Land Conservation and Reclamation Council, which has a Technical Advisory Committee to assist in matters related to the development and administration of a reclamation research program. Research projects conducted under this program are described in the following subprogram areas: Plains Coal Reclamation, Mountains and Foothills Reclamation, Oil Sands Reclamation, and Oil and Gas Reclamation. The objectives of the projects are to develop efficient and effective reclamation methods, to provide scientific data for decisionmaking purposes, and to provide data to evaluate the effectiveness of reclamation guidelines and criteria. The major types of disturbances of concern are those caused by coal mines operated in conjunction with electrical generating plants, metallurgical coal mines and mines producing high-quality thermal coal for export, and oil sand mining and extraction facilities. The reclamation concerns related to the oil and gas industry include disturbances due to drilling waste disposal, compaction of soils, and residual herbicides. A list of research reports, with abstracts, is also included. 11 figs.

2906 Nuclear Energy

Refer also to citation(s) 48255, 48589, 48590, 48835, 48848, 49407

48735 (AD-A–222815/3/XAB) **Development, application and assessment of a taxonomy for characterizing international environmental problems. Master's thesis.** Koehler, M.D.; Marrs, J.A. Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). 1990. 279p. (AFIT/CI/CIA–90-028). Source: NTIS, PC A13/MF A02.

As national leaders become increasingly aware of the environmental risks that modern technology adds to existing natural environmental problems, they have begun to search for ways to prioritize the risks they face. Several experts in risk assessment, including Professor Gordon Goodman of the Stockholm Environmental Institute, researchers at Clark University's Center for Environment, Technology, & Development (CENTED), and the United States Environmental Protection Agency, have already developed some hazard characterization taxonomies that attempt to fill this need. The Kennedy School of Government (KSG) taxonomy if the next iteration of taxonomies designed to characterize environmental problems. The purpose of this Policy Analysis Exercise (PAE) is to test and evaluate the KSG taxonomy. In order to accomplish these goals, the United States and India are presented as case studies. The final section of this PAE provides recommendations to policy makers who use the KSG taxonomy.

48736 (EDF-DER-RA–1989-2) **DER 89: main facts.** Electricite de France (EDF), 75 - Paris (France). 1989. 130p. (In French). Order Number DE91701174. Source: NTIS (US Sales Only), PC A07/MF A01.

This report presents the important facts, in 1989, among the studies carried out by the Direction des Etudes et Recherches (EDF/DER): new applications of electric power for customers, classical equipments for power plants and nuclear equipments, electrical equipment, development and operation of electrical networks, protection of environment, monitoring and control of power plants, informatics and office automation.

48737 **S. 1966: Advanced Nuclear Reactor Research, Development, and Demonstration Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, November 21, 1989.** 22p. Government Printing Office, Washington, DC (US) (1989).

The bill would focus existing programs in nuclear fission research at the Department of Energy and would establish a program for research, development, and demonstration of advanced technologies for the generation of commercial electric power from nuclear fission. The bill authorizes hearings to develop information upon which to base the decisions and recommendations required to comply with provisions of this act.

2907 Transport and Storage

48738 (CERI–90-01036, pp. 1-18, Paper 4) **U.S. regulatory environment.** Court, S.J. (Federal Energy Regulatory Commission, Washington, DC (USA)). Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

The passage of the Natural Gas Policy Act 9 years ago established a gradual and partial deregulation of natural gas prices, creating more competition at the wellhead and exerting more pressure to allow for more flexible transportation rules enabling producer/sellers to deal directly with end-user or distributor/buyers

without middlemen pipeline/merchants. Order No. 500 was issued by the Commission in response to the court's overturning of prior actions due to lack of meaningful access to the competitive wellhead market for customers. Order No. 500 combines an interim rule and a statement of policy addressing take-or-pay, CD adjustments, and grandfathering. The paper describes the various provisions of Order No. 500, giving details of the crediting mechanism and the take-or-pay policy. Those areas of significance to Canadian interests include marketing affiliates, sales rates and certain certificate proceedings. The Commission has proposed standards for tariff and non-tariff related matters and the establishment of an enforcement task force to resolve complaints of discriminatory activities. The Commission is presently reviewing its purchased gas adjustment regulations, mainly to codify Commission decisions on the operation of the PGA mechanisms made over the last few years. Discussion of the current certificate proceedings for new construction, including the Mohave/Kern River application to bring new natural gas service to California, and the provision of an opening for the filing of an application for new construction to the Northeast market, is also included.

2910 Conservation

Refer also to citation(s) 48743, 48808, 48809

2920 Supply, Demand, and Forecasting

Refer also to citation(s) 48141, 48698

48739 (DOE/EIA–0202(90/3Q)) **Short-term energy outlook: Quarterly projections.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. Sep 1990. 16p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE90017866. Source: NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.

The Energy Information Administration (EIA) quarterly estimates of short-term energy supply, demand, and prices are revised in January, April, July, and October for publication in the Short-Term Energy Outlook (Outlook). This issue of the Outlook is a substitute for the third-quarter 1990 issue of the Outlook and incorporates the latest effects on world oil markets from the events in the Persian Gulf. The principal users of the Outlook are managers and energy analysts in private industry and government. The projections in this volume extend through the fourth quarter of 1991. The scenarios are produced using the Short-Term Integrated Forecasting System (STIFS). The STIFS model is driven principally by the following sets of assumptions or inputs: estimates of key macroeconomic variables, a particular set of world oil price assumptions, and assumptions about the severity of weather. Macroeconomic estimates are produced by DRI/McGraw-Hill, but are adjusted by EIA to reflect EIA assumptions about the world price of crude oil, energy produce prices, and other assumptions which may affect the macroeconomic outlook. (The EIA model is available on computer tape from the National Technical Information Service.) The estimates and historical data are based on EIA data published in the Monthly Energy Review, Petroleum Supply Monthly, and other EIA publications. Minor discrepancies between the data in those publications and the historical data in this Outlook are due to independent rounding. All percentage changes are calculated from the values in the tables rather than from any rounded numbers cited in the text. 4 refs., 1 fig., 10 tabs.

48740 (DOE/EIA–M041) **Short-term integrated forecasting system: 1990 model documentation report.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. [1990]. 128p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE90017380. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The Short-Term Integrated Forecasting System (STIFS) was developed by the Office of Energy Markets and End Use and its predecessors within the Energy Information Administration (EIA). STIFS is the integrated system for the development of supply and demand forecasts that are published quarterly in the Short-Term Energy Outlook (Outlook). This report is written for persons who want to know how integrated short-term forecasts are produced by EIA. The demand and price forecasts for petroleum, electricity, coal, and natural gas are described in the second chapter of this report, followed by a section describing the integrating model. This report has been written to comply with the requirements specified in EIA Order EI 5910-3B, "Guidelines and Procedures for Model Documentation," effective October 1, 1985. 24 refs., 6 figs., 72 tabs.

48741 (NEDO-P–2950) **Report on the preparatory investigation of the Pacific energy information network system.** New Energy Development Organization, Tokyo (Japan). Mar 1990. 327p. (In Japanese). Order Number DE91701469. Source: NTIS (US Sales Only), PC A15/MF A01.

In order to collect and analyze promptly and precisely energy information in the nations in the Pacific region, the preparatory investigation was conducted. Countries visited were korea and five ASEAN countries. A high needs for energy information are shown in all countries, and system for collecting domestic energy data is being established. Need is not limited for the information on domestic situation but spreads over on the situation of energy demand and supply of close trading partner countries. It is an urgent task to establish international information exchange system. National Energy Policy Office in Thailand and Office of Energy Affairs in the Philippines start to collect and maintain systematically energy related informa-tion in each country. In other countries, collection and maintenance of energy data and information are conducted steadily, if not systematically. In Kora monthly data are available with about one month time lag. Great interest is shown by all countries to the Pacific Energy Information Nework System, which will cover wide range of energy data. But some countries are not provided with systems to cope with on-line-network immediately. Consequently, efficient system for information exchange, if not on-line-system, seems necessary in this region. To establish the basis of the information system, large expectation for Japan is expressed. 4 figs., 10 tabs.

48742 (NORDIA-TIED–A/1) **International risk factors affecting Finnish energy supplies.** Kasanen, P. (Oulu Univ., Oulu (Finland). Dept. of Geography); Koponen, M.; Kaekoenen, J. Oulu Univ. (Finland). 1989. 86p. (In Finnish). Source: Oulu Univ, Finland.

An examination is made of the structure and development of Finnish fuel imports, world fuel market trends and prospects, and the impact of global environmental concerns on Finnish energy supplies. Attention is focused on the political and economic developments to be expected in the major fuel producing or consuming countries. The aim is to look for factors that could treaten the functioning of Finnish fuel supplies and to suggest ways to avoid or overcome these threats. The research is based on Finnish and international energy statistics, published forecasts for the development of the fuel trade and fuel resources and the latest literature on energy economics and political science. Finland is heavily dependent on foreign fuels, over two thirds of her fuels supply being imported. By far the most important source of imports is the Soviet Union, although Poland is a major supplier of coal. The increase in domestic demands for fuels in these countries, will make it necessary for Finland to diversify the sources of her fuel imports. The suggestions made here include the following: Saudi-Arabia and Kuwait should be considered as possible new sources of oil. Coal could be imported from South Africa, provided that the apartheid policy is discontinued. Norway could provide some natural gas, although a Nordic pipeline system would be needed for this to be possible. Finland should invest in fuel resource exploration and development and in building the necessary infrastructure in the producing countries in order to improve the possibilities for reaching long-term agreements on fuel imports. Imporovements in the effiency of the end users of energy and an increase in the proportion of renewable sources of energy would not only be steps towards a sustainable fuel economy, but would also reduce the country's dependence on imported fuels.

48743 (QMER/BEEN–90-02589) **Evaluation of the energy consumption of the public sector in Quebec, 1985-1986.** Quebec Ministere de l'Energie et des Ressources, PQ (Canada). Bureau de t'Efficacite Energetique. Apr 1988. 26p. (MICROLOG–90-02589). Source: PC Ministere de l'energie et des ressources,

Direction des communications, 5700, 4e av. ouest, D-309, Charlesbourg, PQ, CAN G1H 6R1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This report documents the energy consumption of the public and para-public sector buildings in Quebec from 1985 to 1986. Consumption was 3.51 million or a decrease of 1.7% with respect to the previous year. The specific energy consumption was 1.42 GJ/m^2, or a decrease of 4.1% with respect to the previous year; this number varies from 0.74 GJ/m^2 at the Societe d'Habitation du Quebec (Sud) to 2.32 GJ/m^2 at the Quebec Ministry of Transportation. The breakdown of energy forms is as follows: electricity, 49%; natural gas, 32%; light fuel oil, 16%; heavy fuel oil, 2%; other energy forms, 1%. The corresponding specific costs were: electricity, 11.74 $/GJ; natural gas, 5.56 $/GJ; light fuel foil, 8.25 $/GJ; heavy fuel oil, 5.70 $/GJ. The breakdown of energy consumption was: heating, 53.8%; lighting, 19.4%; ventilation and air conditioning, 12.6%; motive force, 8.2%; other uses, 6.0%. The total cost of this energy consumption was $310.6 million, or a decrease of 0.2% with respect to the previous year, whereas the average price of energy increased by 1.3% during the same period. The investment in energy conservation is estimated to have been $54.6 million, or an increase of 22.4% with respect to the previous year. 16 tabs.

2930 Policy, Legislation, and Regulation

Refer also to citation(s) 48165, 48187, 48188, 48591, 48704, 48738

48744 (MIC–90-03314/XAB) **Background discussion document on energy in New Brunswick, 1990-2000.** New Brunswick Dept. of Natural Resources and Energy, Fredericton, NB (Canada). ©1990. 63p. Source: NTIS, PC EE07/MF E01.

Outline of the role of governments and the private sector in energy development and detailed discussion of energy supply and demand, including indigenous and imported energy supplies and projections of electrical energy demand to 2000. Energy efficiency and conservation is presented as a cornerstone and major initiative to help meet the expected energy needs of the future. A number of major projects being considered in the electrical energy development area are outlined for the 1990s. Details are given on environmental effects and the need for sustainable development. The report concludes with a discussion of transportion and the need for R&D. This document is the initial step in the development of a provincial energy policy and is intended to serve as a background discussion paper for the public consultation process.

48745 (NBNRE–90-03314) **Background discussion document on energy in New Brunswick, 1990-2000.** New Brunswick Dept. of Natural Resources and Energy, NB (USA). 9 Feb 1990. 63p. (MICROLOG–90-03314). Source: PC New Brunswick Legislative Library, Government Documents Section, 766 King St, Fredericton, NB, CAN E3B 5H1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

New Brunswick has only limited indigenous resources such as wood, coal, and hydro, with some geological potential, as yet undeveloped, for oil, gas and oil shale. The province must therefore rely upon an external supply of offshore oil, coal and uranium to meet its energy demand. This document is the first step in the development of a provincial energy policy and is intended as a background discussion paper for the public consultation process. The report first outlines the role of governments and the private sector in energy development, then discusses energy supply and demand in some detail, including indigenous and imported energy supplies and projections of electrical energy demand to 2000. Energy efficiency and conservation are presented as a cornerstone and major initiative. Electrical energy development initiatives include purchases of power from Quebec, the construction of a 100 MW combustion turbine development on the Miramichi River, a multi-fuelled 440 MW plant at Belledune, a 150 MW coal-fired plant at Grand Lake, and a second CANDU nuclear station at Point Lepreau. The environment and sustainable development are discussed in detail. The final section deals with transportation and the need for research and development. 16 figs., 4 tabs.

2940 Fossil Fuels

Refer also to citation(s) 48125, 48140, 48141, 48146, 48147, 48177, 48178, 48180, 48187, 48188, 48728, 48739, 48740, 48742, 48842

48746 (CRFA–90-01413, pp. 1-8, Paper 4) **Effects on the environment of the fuels we are using.** Isaacs, C.F.W. Canadian Renewable Fuels Association (Canada); Biomass Energy Inst., Inc., Winnipeg, MB (Canada). [1989]. (CONF-8910455–: Let's clear the air, Toronto (Canada), 18 Oct 1989; MICROLOG–90-01413). In *Let's clear the air.* Source: PC Biomass Energy Institute Inc., 1329 Niakwa Road East, Winnipeg, MB, CAN R2J 3T4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper is an overview of the environmental problems caused by the use of fossil fuels. The greenhouse effect, ozone pollution at low altitudes, acid rain, lead pollution, and the depletion of the ozone layer are discussed. The author recommends reduction in gasoline consumption, switching to biomass fuels, research into alternative fuels and advocates the principles of sustainable development.

48747 (ESRF–90-03338) **Environmental Studies Research Funds annual report, 1989.** Environmental Studies Research Funds, Ottawa, ON (Canada). [1989]. 53p. (MICROLOG–90-03338). Source: PC Canada Oil and Gas Lands Administration, 355 River Rd., 15th Floor, Tower B, Ottawa, Ont., CAN K1A 0E4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

Initiated in 1983, the Environmental Studies Research Funds (ESRF) is a program of funding for environmental and social studies related to oil and gas development on Canadian frontier lands. A focused program, it deals exclusively with research to assist in decision-making related to oil and gas exploration and development. Funding for the ESRF is provided through levies on the oil and gas companies that hold interests on frontier lands. Administration is provided by the Environmental Protection Branch of the Canada Oil and Gas Lands Administration. Management of the ESRF was restructured in 1988 to include representation from the federal government, the oil and gas industry, the regional petroleum boards and the general public. The bulk of the technical work of the ESRF is performed by a series of Program Study Committees who provide expert advice in priority subject areas identified by the Board. These committees are comprised of scientific and technical experts from the oil and gas industry and the federal, provincial and territorial governments. This report summarizes the year's activities of the ESRF and includes descriptions of current research projects and a list of publications. In 1989, a research program valued at $538,000 was carried out. Six projects are described, focusing on the Grand Banks and the Beaufort Sea. These projects investigated the tainting of commercial fish species by spilled oil, sensitivity of fish larvae to petroleum hydrocarbons, environmental effects monitoring strategies, extreme waves, iceberg scours, and documentation and archiving of marine radar data sets. A list of ESRF reports is included.

48748 (NSME–87-02413) **Nova Scotia oil and gas report, 1986.** Nova Scotia Dept. of Mines and Energy, Halifax, NS (Canada). 1986. 50p. (MICROLOG–87-02413). Source: PC Nova Scotia Mines and Energy, 1701 Hollis St., PO Box 1087, Halifax, NS, CAN B3J 2X1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A review is presented of oil and gas exploration activities and drilling results in Nova Scotia, both onshore and offshore, in 1985-86. The geological setting of the region is described and resource management policies are outlined. Reference is made to offshore safety and training programs, and to terrain restoration work on Sable Island. The potential for development of offshore natural gas discoveries is discussed in terms of reserves, markets, and prices. Also highlighted are significant events involving Nova Scotia's offshore lands since the signing of the Canada-Nova Scotia Agreement on Oil and Gas Resource Management and Revenue Sharing

in March, 1982. These include the drilling of 15 new offshore wells since the beginning of 1985, mostly in the Sable Island area; the acquiring of over 26,000 km of seismic data on the Scotian Shelf and Slope; a decline in average well costs on the Scotian Shelf; and a 1986 total of ca 18,000 feet of wells drilled onshore. A table of well drilling and testing results and a directory of onshore and offshore wells are also included. 21 figs., 5 tabs.

2950 Hydrogen and Synthetic Fuels

Refer also to citation(s) 48842, 48844

2960 Electric Power

Refer also to citation(s) 48150, 48442, 48445, 48496, 48497, 48682, 48736, 48737, 48739, 48740, 48744, 48745, 48771, 48780, 48784, 48794, 48795

48749 (EPRI-CU-6924-Vol.2) **DSM [Demand-Side Management]: Transmission and distribution impacts: Volume 2, Application on spatial frequency analysis: Final report.** Willis, H.L. (ABB Power Systems, Inc., Pittsburgh, PA (USA)); Vogt, L.J.; Tram, H.N.; Fredley, J.M. Electric Power Research Inst., Palo Alto, CA (USA); ABB Power Systems, Inc., Pittsburgh, PA (USA). ©Aug 1990. 159p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

The Application Guide discusses a Spatial Frequency Analysis (SFA) based screening method for estimating the Transmission and Distribution (T&D) System impacts of Demand-Side Management and other changes in end-use devices on electric utility systems. This Guide presents the basic concepts and theory behind the method, and discusses its computerized application to a wide variety of problems, while also providing guidance in the collection of data, use of the method, and interpretation of the results. 33 refs., 31 figs., 8 tabs.

48750 (EPRI-CU-6964) **Cogeneration and independent power production: Market insight and outlook: Final report.** Electric Power Research Inst., Palo Alto, CA (USA); Resource Dynamics Corp., Vienna, VA (USA). ©Aug 1990. 44p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

The way that electric power is generated in the United States is undergoing major changes. An activity which, for most of this century, has been dominated by regulated electric utilities is now being performed by a new class of participants – the non-utility generators. The level of non-utility generator activity, the types of participants, and nature of the non-utility marketplace is evolving rapidly – and in ways that are not entirely predictable. The impacts on electric utilities are likely to be profound, affecting both the basic nature of their business and day-to-day operations. In an attempt to better understand the nature of the evolving marketplace for non-utility power and its impacts on utilities, EPRI commissioned two workshops on this topic. These workshops identified the key factors which drive the non-utility generation market. Subsequently, investigations were conducted into these factors and these are presented in this report. The report is designed to introduce utility staff to the new electric power market of the 1990s, highlighting the need for flexibility and vision in utility planning, marketing, and operations. This report provides an overview of the dominant factors and trends driving the third-party generation market. It draws upon the insights of industry experts including utility executives, regulators, project developers, and financing organizations presented at the two cogeneration roundtable discussions. 4 figs., 3 tabs.

48751 (LBL-22702) **Least-cost planning for Pacific Gas and Electric: Stage 1: Load Management Strategy Testing Model (LMSTM) calibration.** Kahn, E.; Pignone, C.; Comnes, G.A. Lawrence Berkeley Lab., CA (USA). 15 Feb 1987. 71p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE90017899. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report describes the activities undertaken by LBL to calibrate the Load Management Strategy Testing Model (LMSTM) for use in a least-cost planning exercise with the Pacific Gas and Electric Company (PG&E) system. There is a great general interest in analytical procedures that facilitate the integration of demand-side activities into utility resource planning. It is widely recognized that this is a complex problem which requires sophisticated modeling. A reasonable question to ask at the outset is what kind of model should be used for this purpose. This is a difficult problem for which there is little guidance and many competing claims and constraints. LBL has chosen to use the LMSTM model (for a general description of LMSTM see DFI, 1982). The motivation for that choice and the procedures necessary to achieve consistency with the results of PG&E's detailed production simulations are the subject of this report. Understanding these issues requires a survey of the production simulation field, paying special attention to the special problems of representing demand-side resources in the same framework traditionally used to evaluate supply side resources. 32 refs., 16 figs., 12 tabs.

48752 (MAE-90-03908) **Maritime Electric Co. Ltd. annual report, 1989.** Maritime Electric Co. Ltd., Charlottetown, PE (Canada). 1989. 18p. (MICROLOG-90-03908). Source: PC Maritime Electric Co. Ltd., Confederation Court Mall, 134 Kent St., Charlottetown, PE, CAN C1A 7N2; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

Maritime Electric Company is a Canadian investor-owned electric utility based in Prince Edward Island. Established in 1918, the Company owns and operates a fully integrated system providing for the generation, transmission, and distribution of electricity throughout the Island. Maritime Electric operates generating plants in Charlottetown and Borden, and has an equity interest in NB Power's unit in Dalhousie, New Brunswick. Its 4,100 km distribution system and 500 km transmission system are linked to the mainland power grid by two submarine cables between the Island and the province of New Brunswick. This report describes the Company's operations, power production and sales for the year, with relevant statistical information. Financial statements are also included. In 1989, continued provincial economic growth contributed to an electric energy sales growth of 5.3%; however, the growth rate has been steadily declining since mid-1988. A trend is noted toward an increased use of contract energy rather than interruptible energy in regard to energy sources. 4 figs., 2 tabs.

48753 (MPUB-43/90) **Manitoba Hydro application for an order requesting a general rate review and approval of certain rate adjustments effective April 1, 1990.** Manitoba Public Utilities Board, Winnipeg, MB (Canada). 26 Mar 1990. 53p. (MICROLOG-90-03413). Source: PC Manitoba Legislative Library, 200 Vaughan St., Winnipeg, MB, CAN R3C 1T5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

In November 1989, Manitoba Hydro applied to the Public Utilities Board for a review of a proposed revenue increase of 4.5% in general consumer revenue, to be implemented April 1, 1990. Concurrent with this application, Manitoba Hydro applied for final approval of an order dealing with changes in diesel fuel cost rates. This document covers the financial aspects, the cost of service, and rates of the application, including an integrated financial forecast. The board allowed a rate increase of 4.0%, and the resulting reduction in apllied for revenues be allocated toward a reduction in the rates for various classes of general service provided by Manitoba Hydro. A list of witnesses and presenters is included.

48754 (ST-88-28) **Alberta electric industry annual statistics 1987.** Annual statistical series. Energy Resources Conservation Board, Calgary, AB (Canada). 1987. 39p. (CE-03143). Source: PC Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $20.00 CAN; MF $10 CAN.

Statistical information is presented for electric energy generation and capacity, energy resource consumption, utilization and efficiencies, and electric energy distribution in Alberta in 1987. More specifically, data are included on such topics as capacity and generation of power plants, net generation by type of energy resource

and type of generation, on-site generation at industrial plants, stack emissions from thermal plants, hydroelectric utilization and conversion efficiency, energy stored in hydroelectric reservoirs, fuel consumption of thermal plants, power interchange and distribution, number of utility customers, and lengths of transmission lines. A folded map of the Alberta electric system is included. 7 figs., 35 tabs.

48755 (TP–TP9456E) **Electrical power sources inventory for Transport Canada.** Adams, W.A.; Song, G.S. Ottawa Univ., ON (Canada). Electrochemical Science and Technology Centre. Dec 1988. 58p. (MICROLOG–90-04079). Source: PC Transport Canada, Library and Information Centre, Place de Ville, Tower C, Ottawa, ON, CAN K1A 0N5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A systematic survey of power sources used in various sectors of Transport Canada was undertaken in order to define the current and future requirements for these devices. The survey report is classified into sections dealing with batteries and fuel cells, and their incorporation, as applicable, into the following types of power systems: thermoelectric, motor/generator sets, photovoltaic, wind, and uninterruptable power from utility. Batteries are the most numerous power sources and they are used in all sectors (marine, aviation, and airports authority groups). About 50,000 battery packs of different types and sizes of cells are used by these groups within Transport Canada. Another common power source is the diesel motor/generator set, widely used because of its high efficiency and ready availability. About 1,500 diesel generators of various power ranges are in operation by Transport Canada. Photovoltaic power systems have been successfully introduced by the marine group, replacing a number of diesel generators and batteries used for lighthouses and buoys. About 2,500 of these systems are in use. For those locations where ac utility power is available, static uninterruptible power sources are used effectively as backup power sources to ensure the continuity of ac power. The aviation and airports authority groups use about 550 such systems. Other systems such as wind power, thermoelectric generators, and fuel cells play only a minor role in Transport Canada. Although they might meet the power requirements, their cost/energy ratio is too high at their current stage of development and their availability might also be a cause for concern. 9 refs.

2980 Consumption and Utilization

Refer also to citation(s) 48739, 48740, 48771, 48794

2990 Unconventional Sources and Power Generation

Refer also to citation(s) 48469, 48471, 48750, 48829

48756 (CSC–(89)ENP-28) **African energy programme, a perspective of a regional project network.** Okot-Uma, R.W'O. Commonwealth Science Council, London (UK). Jul 1989. 84p. Project document 272. Source: Available from British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ No. DX86048.

The African Energy Programme encompasses regional collaborative research and development in seven project areas. These are: wind energy generation; solar crop drying; wood/charcoal production and utilization; solar heating and cooling, wind water pumping; biogas for rural development; meteorological data for solar and wind energy, and energy policy and planning. This evaluation assesses the overall activities of the Programme in terms of efficiency, results, effects and impacts and presents recommendations for the future. (UK).

30 DIRECT ENERGY CONVERSION

Refer also to citation(s) 48755

3001 MHD Generators

Refer also to citation(s) 48106, 48107

48757 (DOE/PC/70507–T3) **Corrosion and arc erosion in MHD channels: Quarterly progress report, January–March 1990.** Rosa, R.J.; Pollina, R.J. Montana State Univ., Bozeman, MT (USA). Dept. of Mechanical Engineering. 27 Apr 1990. 3p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-84PC70507. Order Number DE90017889. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objective of this task is to study the corrosion and arc erosion of MHD materials in a cooperative effort with, and to support, the MHD topping cycle program. Materials tested in the Avco Research Laboratory/Textron facility, or materials which have significant MHD importance, will be analyzed to document their physical deterioration. Conclusions shall be drawn about their wear mechanisms and lifetime in the MHD environment with respect to the following issues: sulfur corrosion, electrochemical corrosion, and arc erosion. The impact of any materials or slag conditions on the level of power output and on the level of leakage current in the MHD channel will also be noted, where appropriate. The detailed correlation and analysis of data obtained from nearly all of the CDIF tests performed since 1986 has shown that the apparent leakage current flowing through the slag on the channel walls depends upon channel operating parameters in an unexpected way. A comprehensive report of the results obtained to date and a first attempt at their interpretation has been prepared and a copy is attached. The second activity has concerned the examination of electrodes (platinum anodes/tungsten cathodes) by SEM and EDX techniques to determine the nature of the surface degradation. Results of these examinations are reported.

48758 (DOE/PC/90274–T8) **MHD Technology Transfer, Integration and Review Committee: Third semi-annual status report, April–September 1989.** TRW, Inc., Redondo Beach, CA (USA). Applied Technology Div. May 1990. 253p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC90274. (MHD-ITC–90-133). Order Number DE90017886. Source: NTIS, PC A12/MF A01 - OSTI; GPO Dep.

As part of Task 8 of the MHD Integrated Topping Cycle (ITC) project, TRW was given the responsibility to organize, charter and co-chair, with the Department of Energy (DOE), an MHD Technology Transfer, Integration and Review Committee (TTIRC). The TTIRC consists of an Executive Committee (EC) which acts as the governing body, and a General Committee (GC), also referred to as the main or full committee, consisting of representatives from the various POC contractors, participating universities and national laboratories, utilities, equipment suppliers, and other potential MHD users or investors. The purpose of the TTIRC is to: (a) review all Proof-of-Concept (POC) projects and schedules in the national MHD program; to assess their compatibility with each other and the first commercial MHD retrofit plant; (b) establish and implement technology transfer formats for users of this technology; (c) identify interfaces, issues, and funding structures directly impacting the success of the commercial retrofit; (d) investigate and identify the manner in which, and by whom, the above should be resolved, and (e) investigate and assess other participation (foreign and domestic) in the US MHD Program. This report covers the period April 1989 through September 1989. The report is organized into seven sections: introduction; Executive Committee and General Committee activity during this reporting period; committee activities related to technology transfer; ongoing POC integration activities being performed under the auspices of the Executive Committee; recommendations passed on to the DOE by the Executive Committee during this reporting period; planned activities for the next six months.

3005 Fuel Cells

Refer also to citation(s) 48490

48759 (AD-A–223068/8/XAB) **Lightweight solid-polymer electrolyte fuel cell with stack power density of 3 kW/lb (7kW/kg).** Appleby, A.J.; Srinivasan, S. Texas A and M Univ., College

Station, TX (USA). Center for Electrochemical Systems and Hydrogen Research. 1 Jun 1990. 10p. Contract N00014-88-K-0389. Source: NTIS, PC A02/MF A01.

The objectives of this project are to investigate the physicochemical properties of some solid polymer electrolytes and of electrode kinetic parameters of oxygen reduction at the platinum/solid polymer electrolyte interface; optimize electrodes and membrane/electrode assemblies to attain the highest possible power density in fuel cells; and model the performance of an electrochemical cell stack taking into consideration the electrochemical, mass transfer and heat transfer characteristics to demonstrate the feasibility of attaining the stated goals. Highlights of the accomplishments on these tasks are as follows: using a microelectrode technique, the electrode kinetic parameters for oxygen reduction at the platinum-solid polymer electrolyte interface and the oxygen solubility and diffusion coefficient in this electrolyte were determined; with optimized electrode structures and membrane/electrode assemblies, high power densities were attained in solid polymer electrolyte fuel cells (single cells); and the modeling studies reveal that thermal and water management can be effective with recirculation of gases with external condensation, and with thin metallic bipolar plates and assuming a power density of 4 watts/centimeters squared a stack power density of 7 kW/kg can be achieved.

48760 (DOE/METC–90/6112) **Proceedings of the second annual fuel cells contractors review meeting.** Huber, W.J. (ed.). USDOE Morgantown Energy Technology Center, WV (USA). May 1990. 263p. Sponsored by U.S. DOE Fossil Energy. (CONF-900591–: 2. Fuel cells contractors review meeting, Morgantown, WV (USA), 2-3 May 1990). Order Number DE90000490. Source: NTIS, PC A12/MF A01 - OSTI; GPO Dep.

The Second Annual Fuel Cells Contractors Review Meeting was held May 2–3, 1990, at the Lakeview Resort in Morgantown, West Virginia. This meeting was sponsored and hosted by the Morgantown Energy Technology Center of the US Department of Energy. The purpose of this meeting was to bring together the research and development (R&D) participants in the DOE/Fossil Energy-sponsored Fuel Cells Program to present key results of their research. Major emphasis was on phosphoric acid, molten carbonate, and solid oxide technology efforts. Research results of the coal gasification and gas stream cleanup R&D activities pertinent to the Fuel Cells Program were also highlighted. One hundred forty-nine attendees from industry, academia, and Government participated in this 2-day meeting. Twenty-eight papers were given. Individual papers are processed separately for the data bases.

48761 (EUR–12466) **Development of a high performance air cathode for the direct methanol/air fuel cell: Final report.** Burke, L.D. (University Coll., Cork (Ireland). Dept. of Chemistry). Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation; University Coll., Cork (Ireland). Dept. of Chemistry. 1989. 29p. Sponsored by Commission of the European Communities. Contract EN3E/0148/IRL. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg.

The direct methanol/air fuel cell is a galvanic cell. The objective of this contract was to produce an oxygen/air cathode delivering 50 mA cm^{-2} at 0.8 V(RHE) using a platinum loading of 0.5 mg cm^{-2} in aqueous H_2SO_4 at 60°C. Porous electrodes were fabricated and testing was carried out using a computerized test programme involving cyclic voltammetry and steady-state techniques. The performance of the porous electrodes was compared largely with the behaviour of platinized platinum. The effect of many variables, e.g. O_2 pressure, Pt loading, PTFE content, temperature, other metals (e.g. Au rather than Pt), solution pH, layer thickness, was examined, but at no stage was good O_2 reduction performance attained at 0.8 V(RHE). Recent results lead to the suspicion (confirmed within the past few days) that there are significant potential (kR) losses at the Pt/C interface. Attempts to overcome this, and to further improve electrode fabrication with a view to high current density operation, are highly desirable. 3 refs., 13 figs.

48762 (PB–90-252560/XAB) **Electrocatalyst surfaces. Final report, December 1986-November 1989.** Hubbard, A.T. Cincinnati Univ., OH (USA). Dept. of Chemistry. Feb 1990. 33p. Contract GRI-5086-260-1404. Source: NTIS, PC A03/MF A01.

See also PB–88-178629.

Hydrocarbon reaction intermediates adsorbed at metallic catalyst surfaces have been identified and quantitated by means of new surface spectroscopic and electrochemical methods, including electron energy-loss spectroscopy (EELS), Auger spectroscopy, surface infrared spectroscopy (IR), electron diffraction (LEED) and cyclic voltammetry (CV). Investigated were catalyst surface structure, hydrocarbon molecular structure, modes of surface chemical bonding of adsorbed intermediates, and electrochemical oxidation of these intermediates as a function of the nature of the hydrocarbon solvent electrolyte, pH, temperature, catalyst elements and adsorbable additives. Breakthroughs accomplished in the research include: (i) first studies of hydrocarbon adsorbed intermediates at electrocatalyst surfaces by means of very definitive EELS vibrational spectra; (ii) first determinations of elemental analysis, purity, surface abundance and molecular orientation of intermediates by Auger spectroscopy; (iii) advances in surface IR spectroscopy permitting vibrational characterization of intermediates at high pressure; and (iv) voltammetric studies revealing the nature of electrochemical reactions occurring at specific locations in an adsorbed molecule.

48763 (PB–90-255126/XAB) **Manufacture of air electrodes and long run tests.** Lamminen, J.; Kivisaari, J.; Lampinen, M.J.; Viitanen, M.; Vuorisalo, J. Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Thermal Engineering. 1990. 15p. Source: NTIS, PC A03/MF A01.

The study tested some alternative catalysts for oxygen reduction in an alkaline electrolyte. The catalysts tested were CoTMPP, LaNiO3, Pt (for comparison), and MnO2. The electrodes were manufactured by the rolling method. The best electrodes made in this way have been tested in a long run test, testing times ranging from 425 hours to 660 hours. The decay in potential during the 660 hour run was 0.041 mV/h.

48764 (PIRSEM–2012) **High performance electrochemical generators.** Barbier, M.J.; Moi, A.; Poignet, J.C.; Touzain, P.; Kerrou, M. Centre National de la Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matiernes Premieres (PIRSEM). 1986. 23p. (In French). Order Number DE91701151. Source: NTIS (US Sales Only), PC A03/MF A01.

A study concerning accumulators using a solvate type electrolyte, a positive electrode made of oxidized graphite and a negative electrode made of Li/Al. Different new salts (chloride, biomide, halide) are studied, to the used as electrolyte for high performance cells: the required characteristics are a low melting point (100 c), a high electric conductivity and a large non-electroactivity domain.

48765 Controlled-pore-size composite nickel oxide structures for carbonate fuel cell cathodes. Baumgartner, C.E. (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Center). *Journal of the American Ceramic Society (USA)*, 73(3): 516-520 (Mar 1990).

The performance of a molten carbonate fuel cell (MCFC) is significantly eroded when fuel and oxidant gases are allowed to combine chemically as occurs with a loss of gas impermeability by the cell's electrolyte structure. This performance decline is eradicated when the cell's electrodes possess pore size distributions small enough to absorb sufficient electrolyte to act as a secondary gas barrier. Described is a process for preparing composite MCFC NiO cathodes.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

48766 (EMR–90-02761) **The Federal Energy R&D Program: Putting imagination to work.** Department of Energy, Mines and Resources, Ottawa, ON (Canada). 1989. 47p. (MICROLOG–90-02761). Source: PC Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4; MF CANMET/TID, Energy, Mines and Resources Canada,

555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Since 1974 the Canadian federal energy R&D program, working through 13 federal departments and agencies, has been developing new technologies and creating opportunities, in areas as diverse as domestic furnaces and global warming. This booklet documents examples and case histories of the program. It covers projects for energy efficiency and diversification, health and safety, the environment, industrial growth, regional development, and future technologies. Included are: lists of international Energy agency agreements for cooperative R&D in which Canada is a participant; federal departments and agencies which have participated in the interdepartmental Panel on Energy R&D; and the programs carried out by the federal Panel for Energy R&D.

3201 Buildings

Refer also to citation(s) 48442, 48472, 48473, 48807, 49562

48767 (AFME–86-04-0038) **Experimental study of aeraulics heating. Final Report.** Proix, R.; Aubineau, A.; Lelong, V. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). Jun 1987. 103p. (In French). Order Number DE91701158. Source: NTIS (US Sales Only), PC A06/MF A01.

An experimental study on medium temperature (40c) hot air space heating is realized in order to determine the realistic characteristics of the equipment to be implemented. The experimental survey was concerned with the following main themes: hot air emission and distribution system, regulation system, air renewal, hot air space heating and thermal comfort. Optimization of the flow rate and temperature coupling is discussed, with emphasis on the hot air space heating of the humid rooms.

48768 (AFME–86-91-0001) **Development of an operating aid device for ground water heat pump system.** Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France); Ecole Nationale Superieure des Mines, 75 - Paris (France). 1987. 48p. (In French). Order Number DE91701152. Source: NTIS (US Sales Only), PC A03/MF A01.

The aim of this study was to develop a data acquisition and processing system in order to inform the operator of a ground water heat pump space heating system with the operation conditions and performances, quality control data,... The system is composed of a data acquisition system connected with the telephone network to a Minitel or a PC; a sensor system and an operation software.

48769 (CEEA–827U675-Vol.1) **Engineering manual for the design and installation of ground and water source heat pump systems: Volume 1.** Geddes, W.D. Canadian Earth Energy Association, Dunrobin, ON (Canada). Mar 1990. vp. (CE–03120). Source: Canadian Electrical Association, One Westmount Square, Suite 500, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

A design guide is provided for both closed-loop ground source and open-loop water source heat pump systems. Current technical information is provided in accordance with Canadian standards. Correct practices of many successfully operating systems, generally applicable to residential and light commercial buildings, are summarized. Specific recommendations are given for the following: selection of system components, including plastic pipe, antifreeze solutions, circulating pumps, and water-source heat pumps; design configurations and pipe sizing procedures for ground-loop systems; design procedures for the buried piping system to ensure a long, trouble-free life; and procedures for burying a closed loop of plastic pipe. A certain amount of background theory and information on economic viability is also included, as well as Canadian climatic data and a glossary. 150 figs., 47 tabs.

48770 (CEEA–827U675-Vol.2) **Installer's manual for the design and installation of ground and water source heat pump systems: Volume 2.** Geddes, W.D. Canadian Earth Energy Association, Dunrobin, ON (Canada). Mar 1990. vp. (CE–03121). Source: Canadian Electrical Association, One Westmount Square, Suite 500, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

An installation guide is provided for both closed-loop ground source and open-loop water source heat pump systems. Current technical information is provided in accordance with Canadian standards. Correct practices of many successfully operating systems, generally applicable to residential and light commercial buildings, are summarized. Specific recommendations are given for the following: selection of system components, including plastic pipe, antifreeze solutions, circulating pumps, and water-source heat pumps; design configurations and pipe sizing procedures for ground-loop systems; design procedures for the buried piping system to ensure a long, trouble-free life; and procedures for burying a closed loop of plastic pipe. A series of troubleshooting procedures is presented, complete with charts, in order to facilitate system maintenance. A certain amount of background theory and information on economic viability is also included, as well as Canadian climatic data and a glossary. 133 figs., 40 tabs.

48771 (CONF-901097–1) **Commercial sector gas cooling technology frontier and market share analysis.** Hamblin, D.M. (Hamblin (Dan) and Associates, Inc., Conway, AR (USA)); Pine, G.D.; Maddigan, R.; MacDonald, J.M.; McLain, H.A.; Rimpo, J.Y. Oak Ridge National Lab., TN (USA). [1990]. 14p. Sponsored by U.S. DOE Conservation & Renewable Energy; Gas Research Institute. DOE Contract AC05-84OR21400. From IAEE North American conference; Ottawa (Canada); 1-3 Oct 1990. Order Number DE90017022. Source: NTIS, PC A03/MF A01 - OSTI.

The cooling profile for commercial buildings shapes the afternoon, summer peak for many electric utilities. Their high generating costs to meet expanding commercial sector and coincident loads are reflected in increasingly complex rate structures attempting to discriminate among, and value competing peak demands. Alternative fuels do not bear the generation-cost penalties embedded in these rates. As a result, cooling technologies higher in first cost than are competing electric options can be least in levelized or life-cycle cost, and socially preferred in terms of total efficiency of energy conversion and use. Prudent commercial cooling R&D planning decisions require market assessment methods which realistically incorporate these factors. Far-sighted planning also looks at technology with initially estimated high first costs. Before rejecting these blueprints, the R&D planner would like to know what it would take to achieve economically viable market shares. Then, he or she can assess whether these operating parameter, cost, and/or performance goals are attainable. This paper describes a method, developed for the Gas Research Institute of the United States, that can assist planning for commercial sector natural gas cooling systems R&D. These systems are higher in first cost than conventional electric chillers. Yet, engine-driven chiller designs exist which are currently competitive in US markets typified by high electricity or demand changes. 10 refs., 4 figs., 3 tabs.

48772 (CONF-901194–1) **Thermal performance analysis for heat exchangers using nonazeotropic refrigerant mixtures.** Granryd, E. (Royal Inst. of Tech., Stockholm (Sweden)); Conklin, J.C. Oak Ridge National Lab., TN (USA). [1990]. 9p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From ASME winter annual meeting; Dallas, TX (USA); 25-30 Nov 1990. Order Number DE90016030. Source: NTIS, PC A02/MF A01 - OSTI.

Nonazeotropic refrigerant mixtures (NARMs) are under investigation to replace chlorofluorocarbon compounds. This analysis describes a general approach for analyzing the thermal performance of heat exchangers using NARMs. The thermal performance of a NARM evaporator or condenser is analyzed as a heat exchanger operating between two fluids, one of which has a varying specific heat with respect to enthalpy. For NARMs in the two-phase region, the saturation temperature is not only a function of pressure, but also of vapor quality or enthalpy. Many NARMs have nonlinear enthalpy and temperature relationships in the two-phase region that require corrections to the conventional heat exchanger thermal performance relationships. A pinch point may occur under certain conditions in the heat exchanger, with the resultant penalties. These pinch points may be avoided by selecting a NARM with a desirably shaped temperature-enthalpy curve so that a condenser or evaporator will have a desirable thermal

performance. A criterion is presented to identify when such a desirable thermal performance occurs in heat exchangers. Heat exchanger effectiveness and number of transfer units (NTU) relationships are presented for fluids having an assumed linear and quadratic dependence of specific heat with respect to quality. The thermal performance method is general, such that NTU effectiveness relationships can be generated for fluids having a specific heat that is an arbitrary function of quality. 5 refs., 10 figs.

48773 (CONF-901194–2) **Tubeside evaporation of nonazeotropic refrigerant mixtures from two enhanced surfaces.** Conklin, J.C.; Vineyard, E.A. Oak Ridge National Lab., TN (USA). [1990]. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From ASME winter annual meeting; Dallas, TX (USA); 25-30 Nov 1990. Order Number DE90016037. Source: NTIS, PC A02/MF A01 - OSTI.

As part of the Building Equipment Research program at Oak Ridge National Laboratory, nonazeotropic refrigerant mixtures (NARMs) are being investigated to replace chlorofluorocarbon compounds. The evaporation of NARMs is not isothermal, and this can improve the heat exchanger effectiveness of an evaporator as well as improve thermodynamic cycle efficiencies. The evaporating heat transfer coefficient for four nonazeotropic mixtures of refrigerants R143a and R124 was investigated for two inside tube surfaces, one having spiral ridged fins and the other a corrugated or fluted surface. Refrigerant R22 was also evaporated for comparison of the finned and fluted enhanced surface performances. The measured pressure drop and the heat transfer coefficient for the complete evaporation from 25% quality to a slight amount of superheat of the NARMs and R22 are presented as a function of mass flux for both enhanced surfaces. Both the heat transfer coefficient and the pressure drop of the fluted tube are higher than those of the finned tube at both a given refrigerant mass flux and a given heat exchanger load for all the refrigerant mixtures. When plotted as a function of the mass fraction of R143a, the heat transfer coefficient for the fluted tube is minimal at approximately 40% (51% by mole) by mass of R143a. However, the heat transfer coefficient for the finned tube did not show a degradation as a function of R143a mass fraction, and it appears to be a linear function of the mass fraction of R143a for a given mass flux. 10 refs., 9 figs.

48774 (DOE/ER/60888–1-Vol.1) **Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 1: Final report.** Canada Mortgage and Housing Corp., Ottawa, ON (Canada). 1990. 786p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER60888. (CONF-900724–Vol.1: 5. international conference on indoor air quality and climate, Toronto (Canada), 29 Jul - 3 aug 1990). Order Number DE90017786. Source: NTIS, PC A99/MF A01 - OSTI; GPO Dep.

This volume contains papers on indoor air presented at the Fifth International Conference on Indoor Quality and Climate. Topics include: Allergic and other sensitivity reactions, health effects of unvented indoor fuel burning, health effects of building-associated microorganisms and diseases, human performance and productivity, controlled human exposure studies, epidemiological studies and risk assessment, perceived air quality and comfort, and climate and comfort: thermal lighting, acoustics, spatial, and psychological. Individual papers are indexed separately and entered on the energy database.

48775 (DOE/ER/60888–1-Vol.2) **Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 2: Final report.** Canada Mortgage and Housing Corp., Ottawa, ON (Canada). 1990. 783p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER60888. (CONF-900724–Vol.2: 5. international conference on indoor air quality and climate, Toronto (Canada), 29 Jul - 3 aug 1990). Order Number DE90017787. Source: NTIS, PC A99/MF A01 - OSTI; GPO Dep.

This volume contains papers on indoor air presented at the Fifth International Conference on Indoor Air Quality and Climate. Topics include: Bioaerosols, biological indicators, combustion products and particles, exposure measurement and assessment, and organic compounds. Individual papers and indexed separately on the energy database. (KJD)

48776 (DOE/ER/60888–1-Vol.3) **Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 3: Final report.** Canada Mortgage and Housing Corp., Ottawa, ON (Canada). 1990. 756p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER60888. (CONF-900724–Vol.3: 5. international conference on indoor air quality and climate, Toronto (Canada), 29 Jul - 3 aug 1990). Order Number DE90017788. Source: NTIS, PC A99/MF A01 - OSTI; GPO Dep.

The volume contains papers on indoor air presented at the Fifth International Conference on Indoor Air Quality and Climate. Topics include: Radon and radon progeny, air cleaning and purification, building design, commissioning and operation, radon diagnosis and mitigation, and emissions from and sorption by equipment, materials, and products. Individual papers are indexed separately on the energy database.

48777 (DOE/ER/60888–1-Vol.4) **Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 4: Final report.** Canada Mortgage and Housing Corp., Ottawa, ON (Canada). 1990. 686p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER60888. (CONF-900724–Vol.4: 5. international conference on indoor air quality and climate, Toronto (Canada), 29 Jul - 3 aug 1990). Order Number DE90017789. Source: NTIS, PC A99/MF A01 - OSTI; GPO Dep.

This volume contains papers on indoor air presented at the 5th International Conference on Indoor Air Quality and Climate. Topics include: heating, humidifying and air-conditioning systems, models for predicting air quality, ventilation, biological contamination, diagnosis and mitigation, and multidisciplinary studies. Individual papers are indexed separately on the energy database.

48778 (DOE/ER/60888–1-Vol.5) **Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 5: Final report.** Canada Mortgage and Housing Corp., Ottawa, ON (Canada). 1990. 372p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER60888. (CONF-900724–Vol.5: 5. international conference on indoor air quality and climate, Toronto (Canada), 29 Jul - 3 aug 1990). Order Number DE90017790. Source: NTIS, PC A16/MF A01 - OSTI; GPO Dep.

This volume contains papers on indoor air presented at the 5th International Conference on Indoor Air Quality and Climate. Topics include: plenary lectures, forums, an author index, a keyWord index, and a list of exhibitors. Individual papers are indexed separately on the energy database.

48779 (EI–90-03390) **Economics of cool storage for Bell Northern Research Lab 5, Ottawa, Ontario, and a comparison of chilled water with three types of ice storage modules.** Engineering Interface Ltd., Willowdale, ON (Canada). Jun 1989. 44p. Contract EMR 23440-8-9081. (MICROLOG–90-03390). Source: PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The escalating cost of new electric generation has inspired the investigation of concepts for levelling demand and improving electric load factors. One possibility for load levelling has been cool storage. This study examines the economics of cool storage and compares the viability of several types of cool storage hardware at the Bell Northern Research Laboratories. A description of the premises, maximum cooling profiles, potentials for cool, ice and chilled water storage, and the energy requirements of the storage alternatives are given. 16 figs., 8 tabs.

48780 (EPRI-CU–6969) **Geothermal ground-loop preinstallation project at Walden Pond: Final report.** Lyle, M.C. (Public Service Co. of Indiana, Inc., Plainfield, IN (USA)); Cook, J.J. Electric Power Research Inst., Palo Alto, CA (USA); Public Service Co. of Indiana, Inc., Plainfield, IN (USA). ©Aug 1990. 39p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

A description of a project in which multiple geothermal ground loops were preinstalled in a residential subdivision is presented. The roles of project participants–an electric utility, a home builder, and equipment and service provides–are explained. Information on

system design, specifications, and installation is provided. Installation challenges and costs are detailed. Benefits of the project and implications for future mass preinstallation projects are presented. 12 figs.

48781 (EUR–12533) **Dynamic study of solid adsorption heat pumps: Experiments and numerical simulation economic analysis for development: Final report.** Douss, N. (Centre National de la Recherche Scientifique, 91 - Orsay (France). Lab. d'Informatique pour la Mecanique et les Sciences de l'Ingenieur); Abdallah, K.; Grenier, P.; Guilleminot, J.J.; Gurgel, J.; Sun, L.M.; Sahnoune, H.; Meunier, F. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation; Centre National de la Recherche Scientifique, 91 - Orsay (France). Lab. d'Informatique pour la Mecanique et les Sciences de l'Ingenieur. 1989. 79p. Sponsored by Commission of the European Communities. Contract EN3E-0097-F. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg.

Thermodynamic study of fixed bed adsorption cycles using two pairs: zeolite-water and activated carbon-methanol proved the interest on one hand of the activated carbon-methanol pair for refrigeration (−20°C to +10°C) and on the other hand of multibed cycles. A three adsorber cycle combining a high temperature two adsorber zeolite-water cycle and a low temperature intermittent activated carbon-methanol cycle yields a cooling COP equal to 1 far air conditioning which is an excellent ratio. As two components (evaporator and adsorber) are rate limiting for those cycles, solutions for improvements were sought after. A good solution was found for methanol evaporation, it consists of a climbing film (or vapour lift) evaporator. To optimize fixed bed adsorbers, experimental results prove that bimodal beds did not lead to good results as long as low pressure conditions are required whereas metallic foam addition led to very good results. Isotherm measurements of natural zeolite from Messina showed that this zeolite samples were not adapted to heat pump applications since their adsorption capacity is too low. 104 refs., 60 figs., 19 tabs.

48782 (HME–90-03778) **Field investigation of domestic hot water tanks as space heating appliances: Final report.** Thrall, R.; Mayhew, W.J. Howe (C.D.) Inst., Toronto, ON (Canada). 25 Apr 1989. 81p. (MICROLOG–90-03778). Source: PC Canada Mortgage and Housing Corporation, Annex Bldg., 682 Montreal Rd., Ottawa, ON, CAN K1A 0P7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The trend towards energy efficient housing has resulted in significant reductions in the space heating load. As a result, the size and output required for the heating appliances has also decreased, and the domestic hot water load has replaced space heating as the dominant heating load. This project investigated the state and condition of three domestic hot water tanks that have been in service in the Northwest Territories for six years, as combination hot water and space heating appliances. An assessment of the overall condition of the tanks, including the degree of deterioration/corrosion of the liner, condition of the burner and the quality of the water, was carried out. In addition, a radiator and plumbing pipe were examined. The inspection of the domestic hot water tanks showed little evidence of deterioration of the tanks beyond what would be expected after six years of normal service. The glass liners were intact and the anodes remained effective. Apart from the increased duty cycle, there would be little functional difference between using hot water tanks for water heating and for space heating. The cost analysis showed that the capital, installation and maintenance costs for providing space heating with a domestic hot water tank are lower than those for conventional systems. It has been concluded that a formal application for the revision to the Canadian standard should be made. 23 refs., 11 figs., 5 tabs.

48783 (LBL–28197) **Integration of simulation into building design: The need for a joint approach.** Augenbroe, G (Technische Hogeschool Delft (Netherlands). Building Physics Group); Winkelmann, F. Lawrence Berkeley Lab., CA (USA). Sep 1989. 19p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. (CONF-900449–10: 12. annual American Society of Mechanical Engineers (ASME) international solar energy conference, Miami, FL (USA), 1-4 Apr 1990). Order Number DE90016619. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We describe the need for a joint effort between design researchers and simulation tool developers in formulating procedures and standards for integrating simulation into the building design process. We review and discuss current efforts in the US and Europe in the development of next-generation simulation tools and design integration techniques. In particular, we describe initiatives in object-oriented simulation environments (including the US Simulation Problem Analysis Kernel, the UK Energy Kernel System, the Swedish Ida system, and the French ZOOM program) and consider the relationship of these environments to recent R&D incentives in design integration methodology provided by the Commission of the European Community (the COMBINE program). Topics discussed include the role of simulation in building design, deficiencies of current energy performance evaluation tools, characteristics of intelligent building design systems, transfer of data and knowledge between simulation and design, and the STEP standards for the exchange of product model data. 23 refs., 5 figs.

48784 (LBL–28268) **Program experience and its regulatory implications: A case study of utility lighting efficiency programs.** Krause, F.; Vine, E.; Gandhi, S. Lawrence Berkeley Lab., CA (USA). Oct 1989. 142p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE90016281. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This report takes an approach to utility demand-side program experience that differs from previous work in both focus and methodology. The assessment of program experience is limited to one specific end-use of electricity, i.e. lighting. Program approaches of a limited number of exemplary or illustrative programs are described and analyzed in depth. And the lessons learned about how to conduct effective programs are reviewed in terms of the implications for the evolving practice of least-cost utility planning (LCUP). 3 refs., 1 fig., 5 tabs.

48785 (NEI-FI–113) **Energy conservation and hospital hygiene.** Tarvainen, K. (Ekono, Helsinki (Finland)). Sairaalaliitto, Helsinki (Finland). 1990. 175p. (In Finnish). Source: Sairaalaliitto, Helsinki, Finland.

This publication contains the results of the study 'The Effects of Energy Saving Measures on Hospital Hygiene' The study was ordered by the Finnish Hospital League and made by EKONO Oy's HVAC Engineering department. It was financed by the Energy department of the Ministry of Trade and Industry, fifteen Finnish central hospitals, the National Board of Health and the Finnish Hospital League. The study consists of a report part, an experimental part, the measurements of which were made in six operating rooms and six patient rooms, and recommendations collected for the design of operating and patient rooms. The microbe concentration of air was lower with laminar flow system than with turbulent air flow. The microbe concentration decreased as the air change rate increased. The laminar flow system with the recirculation of air per operating room improves the air purity while reducing energy consumption. On the basis of the microbe and particle samples collected at the site of the wound, at most 5.0% of the equal and more than 5.0 μm particles were colony forming units. As the major part of the particles in operating rooms originates from the personnel, the follow-up of clean room behaviour is important. The CO2 content, temperature and relative moisture of the air were followed in patient rooms when in normal use. The results showed that the constant air flow system is not sufficient in all loading conditions, particularly not in chronics' rooms. Reducing ventilation rate in one test room in the night-time did not deteriorate the air quality substantially. When determining the air flow of a patient room, additional loads caused by personnel, patient's condition and visitors should be taken into account. By means of modern control engineering it is possible to change ventilation to more flexible and to also avoid wasting of energy.

48786 (OH/RD–89-231-K) **Thermal performance and delivery capability of an electric water heater with a**

non-pressurized plastic tank. Riddersma, J.A.; Howell, B.T. Ontario Hydro, Toronto, ON (Canada). Research Div. 24 Oct 1989. 9p. (MICROLOG–90-03524). Source: PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

A prototype electric water heater with a non-pressurized plastic tank and extensive thermal insulation was tested for thermal performance and delivery capability according to the applicable Canadian standard. The heater satisfied the requirements of the standard with an especially low stand-by loss. The reliability of its pumping system needs improvement. 1 refs., 5 figs., 2 tabs.

48787 (OMAF–89-4057) **Growth room temperature control with water-source heat pumps.** Spieser, H.; Pitblado, R. Ontario Ministry of Agriculture and Food, Toronto, ON (Canada); Ridgetown Coll. of Agricultural Technology, ON (Canada). 1989. 12p. (CONF-890639–: 29. annual conference of the Canadian Nuclear Association and the 10th annual conference of the Canadian Nuclear Society, Toronto (Canada), 4-7 Jun 1989; MICROLOG–90-03940). Source: PC Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, CAN N1H 6N1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Water-source heat pumps were used to maintain the temperatures in 8 insect growth rooms used for year-round production of insects for agricultural research purposes. A copper ground loop installed in a municipal drain acted as the heat source/heat sink. Programmable thermostats were used to provide room temperatures within 1°C of setpoint and to enable simulation of day/night temperature fluctuations. The system has been in operation for 3 years, and in that time the heat pumps have worked very well, providing temperature control better than expected. The operating costs for the system range from $0.71 per room per day for heating at -3°C to $0.90 per room per day at 27°C for cooling. One problem with the heat pumps is humidity control. In the cooling mode, the pumps dehumidify the air and additional moisture has to be added (using a drum-type humidifier) to maintain relative humidity at the required level of 85% or more. 5 figs., 1 tab.

48788 (OMAF/AE–88-07) **Partial room brooding for poultry.** Rothwell, T.M. Ontario Ministry of Agriculture and Food, Delhi, ON (Canada). Agricultural Energy Centre. [1988]. 4p. (CE–03144). Source: Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, CAN N1H 6N1. Prices: N/C.

It has been customary in poultry breeding to brood chicks in the same floor area allotted to full-grown birds. In response to possible energy shortages and price increases, and to improve profitability, some Ontario growers have reasoned that heating costs could be lowered if chicks, which require less floor space per bird, could be confined to a portion of the barn, thereby eliminating the need to heat the unused section. This strategy is known as partial room brooding (PRB) and has met with varying acceptance within the Ontario poultry industry. Dividing the barn into two or more brooding zones may be accomplished by using materials such as 4- or 6-mil polyethylene film, reusable corrugated plastic, or insulated panels. Although no complete documented reports from Ontario are available, it is suggested that a 200- by 40-foot electrically heated barn divided in half by a 4-mil polyethylene PRB curtain could save about 8,800 kWh in conductive heat losses alone. Additional heat savings may be anticipated due to lowered infiltration and possibly ventilation heat losses, and additional energy savings are possible by not lighting the unused portion of the barn. In the example mentioned above, this would mean an additional 6,000 kWh saved during the first 3 weeks of each crop. The savings in heating and lighting cost are estimated at around $750/y. Implementing PRB entails a relatively small cost for materials, but some equipment alterations would usually be required and their cost would have to be taken into account when assessing the feasibility of PRB for a particular operation. 3 figs., 1 tab.

48789 (OMAF/AE–88-4510) **Evaluation of dehumidifiers in a rose greenhouse.** Ontario Ministry of Agriculture and Food, Delhi, ON (Canada). Agricultural Energy Centre. May 1988. 18p. (MICROLOG–90-03939). Source: PC Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, CAN N1H 6N1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The performance of two dehumidifiers in a commercial greenhouse growing roses was evaluated. The parameters measured to determine the effectiveness of the dehumidifers were relative humidity, amount of condensate produced, electrical energy consumption, and air flow rate through the dehumidifiers. It was found that a greenhouse operating with dehumidifiers had less swing in relative humidity levels than a greenhouse without dehumidification. The instantaneous coefficient of performance of the dehumidifier system was calculated at 1.37. The economic benefit was not quantified since comparative heating data were not obtained. However, since relative humidity can be reduced to the desired levels without introducing cold outside air for ventilation, extra heat is not required to warm this air and energy for heating is thus saved. In addition, the dehumidifier system recovers the latent heat from the greenhouse air which passes through it and puts it back as sensible heat. Another benefit is that since the ventilation rate is reduced, the carbon dioxide level in the greenouse is not reduced and the plants grow better. 2 figs., 2 tabs.

48790 (OMAF/AE–89-08) **Energy efficient lighting options.** Ontario Ministry of Agriculture and Food, Delhi, ON (Canada). Agricultural Energy Centre. [1989]. 7p. (CE–03145). Source: Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, CAN N1H 6N1. Prices: N/C.

Lighting energy accounts for a significant portion of total energy use on Ontario farms. A number of cost-effective options are available to help reduce energy use and operating costs. These include high-efficiency incandescent lamps and fluorescent tubes, fluorescent power reducers, energy-efficient ballasts, and electric discharge lamps. The characteristics of these lighting options are outlined and a method is provided for cost evaluation of different lighting systems for a particular application. Sample calculations are presented to illustrate the savings possible when replacing an existing lighting system. 2 figs., 3 tabs.

48791 (PB–90-250630/XAB) **Development of the fuzzy control system for heat-pump air conditioners.** Imaiida, T. Mitsubishi Heavy Industries Ltd., Tokyo (Japan). ©1990. 6p. Source: NTIS, PC A06/MF A01.

Text in Japanese.; Pub. in Mitsubishi Juko Giho, Vol. 27, No. 2, 169-173(1990).

The need for increased comfort, energy saving and low noise through the use of heat pump air conditioners is gaining momentum in society. Thus, a new heat pump inverter-type air conditioner which is controlled by fuzzy theory has been developed in response to the great demand for comfort. The control algorithm is constructed so that its operation depends on the rules being experienced. The paper describes the transient simulation technique applied in the development of this new heat pump air conditioner by fuzzy control, and the merits of the system.

48792 (PB–90-252586/XAB) **State-of-the-art interior-piping-systems applications: Commercial buildings. Final report, June 1987-June 1989.** Willman, A.J.; Stanton-Hoyle, D. ACEC Research and Management Foundation, Washington, DC (USA). Jun 1990. 155p. Contract GRI-5087-271-1550. Source: NTIS, PC A08/MF A01.

See also PB–89-219240.

Four types of commercial buildings were identified as candidates for the use of semi-rigid tubing: low-rise offices, low-rise motels, retail buildings, and high-rise residential buildings. For each building type, design documents were obtained for a specific building. The installation costs for a conventional low-pressure rigid steel piping system and elevated-pressure (2-5 psig) corrugated stainless steel tubing and copper tubing semi-rigid systems were estimated. In addition, the installation cost of an all-electric HVAC system was estimated for each building. The results of these studies indicated that the semi-rigid tubing systems were more cost effective than the rigid steel piping system. Further, the installation cost of gas HVAC systems in the four buildings was nearly equivalent to the installation cost of all-electric HVAC systems. Field tests

conducted at a strip shopping center and a three-story motel also indicated that the semi-rigid tubing was more cost effective than the rigid steel pipe system.

48793 (PNL–7397) **Japanese power electronics inverter technology and its impact on the American air conditioning industry.** Ushimaru, Kenji. Pacific Northwest Lab., Richland, WA (USA); Energy International, Inc., Bellevue, WA (USA). Aug 1990. 77p. Sponsored by U.S. Department of Commerce; U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. Order Number DE90014843. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Since 1983, technological advances and market growth of inverter- driven variable-speed heat pumps in Japan have been dramatic. The high level of market penetration was promoted by a combination of political, economic, and trade policies in Japan. A unique environment was created in which the leading domestic industries– microprocessor manufacturing, compressors for air conditioning and refrigerators, and power electronic devices–were able to direct the development and market success of inverter-driven heat pumps. As a result, leading US variable-speed heat pump manufacturers should expect a challenge from the Japanese producers of power devices and microprocessors. Because of the vertically-integrated production structure in Japan, in contrast to the out-sourcing culture of the United States, price competition at the component level (such as inverters, sensors, and controls) may impact the structure of the industry more severely than final product sales. 54 refs., 47 figs., 1 tab.

48794 (PNL–7449) **Comparison of ELCAP data with lighting and equipment load levels and profiles assumed in regional models.** Taylor, Z.T.; Pratt, R.G. Pacific Northwest Lab., Richland, WA (USA). Sep 1990. 97p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. Order Number DE90017517. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The analysis in this report was driven by two primary objectives: to determine whether and to what extent the lighting and miscellaneous equipment electricity consumption measured by metering in real buildings differs from the levels assumed in the various prototypes used in power forecasting; and to determine the reasons for those differences if, in fact, differences were found. 13 refs., 47 figs., 4 tabs.

48795 (PNL-SA–18436) **The practical challenges of converting end-use data into information.** Connor, C.; Stoops, J.; Halverson, M. Pacific Northwest Lab., Richland, WA (USA). Jul 1990. 10p. Sponsored by U.S. DOE Bonneville Power Administration. DOE Contract AC06-76RL01830. (CONF-9007159–1: End-use load and its role in DSM, Irvine, CA (USA), 11-12 Jul 1990). Order Number DE90016538. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper focuses on issues faced by large-scale end-use data collection projects after the project design and meter installation. End-use data load data analysis presents unique problems, often centered on data management. The sheer size of the data collected, the frequency of change in the metered buildings, the need for integration of metered data and building characteristic data, and the need for information rather than just raw data are all problems that each new project must face. 1 fig., 1 tab.

48796 (TKK-KO/LVI–B27) **The development of an integrating tracer gas method for ventilation measurements.** Saeteri, J.; Jyske, P.; Majanen, A. Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Heating, Ventilation and Air Conditioning. 1990. 94p. (In Finnish). Source: Helsinki Univ of Technology, Otaniemi, Finland, Lab of Heating, Veatilation and Air Conditioning.

The objective of this work was the development and testing of a field measurement method for ventilation measurements. This study concentrated on the measurement of ventilation in dwellings. Based on preliminary studies the passive perfluorocarbon method was selected for further development. With this method the ventilation rate and internal air flows of a building can be measured with minimal field equipment. The passive perfluorocarbon method can be used to measure the time-averaged turn over time for each ventilation zone. The measurement inaccuracy of the passive perflurocarbon method was studied in laboratory conditions with constant air flow. The inaccuracy was found to be within +-20%, when PMCP or PMCH were used as the tracer gas. The mixing of the tracer within the ventilation zones was studied in the test apartment. The tracers mixed generally well, the relative standard deviations of the concentrations being below +-10%. Field measurements were carried out twice in 50 Finnish dwellings. The mixing of the tracer was uniform, if the interior doors in the zones were open most of the measurement time. The relative standard deviations of concentration varied between +-1% and +-25%. The field measurements were evaluated afterwards using an optimal condition number technique. The theoretically calculated errorbounds for the field measurements varied generally getween 15 and 25%. Field measurements were made in 291 residences. While comparing different ventilation systems, it was found out that the best values were achieved with mechanical systems. The differences between balanced and exhaust systems were low. The ventilation rates were somewhat lower for natural ventilation systems. The variations from one house to another were the highest among natural ventilation systems. Houses with either too low or too high ventilation rates were common for all ventilation systems.

48797 **Affordable comfort III program.** 88p. Action-Housing, Inc., Pittsburgh, PA (US) (1988). (CONF-8811288–: 3. affordable comfort, Pittsburgh, PA (USA), 29 Nov - 1 dec 1988).

Eighty-five percent of the housing units that will be occupied in the year 2000 in the United States have already been built. This adds up to more than 85 million dwellings. The energy bill for this housing stock is staggering. Increasing the energy affordability of this housing stock can have a profound influence on the quality of life and well-being of our neighbors, our communities, and our nations. Subjects which were covered in the conference include: diagnostic approaches, technical fixes, mobile homes, housing/energy integrated solutions, measuring results, multifamily dwellings, mobilizing resources, public education, health and safety.

48798 **Radon.** Stevenson, T. (HUD, Pittsburgh, PA (USA)); Brennan, T.M. pp. 16 of Affordable comfort III program. Action-Housing, Inc., Pittsburgh, PA (US) (1988). (CONF-8811288–: 3. affordable comfort, Pittsburgh, PA (USA), 29 Nov - 1 dec 1988).

Designed as an introductory session for realtors and those in the housing and energy industry, this workshop presents an overview on radon. The following questions are addressed: What is radon? How is it measured? What are its health risks? What mitigation strategies have been found to be effective? What are the implications of radon occurrence to housing and energy professionals? As a result of this workshop, participants will: (1) Understand what radon is, and the nature of its occurrence in homes; (2) Understand the health effects of exposure to radon and how we know about them; (3) Be aware of the possible interaction among client behavior, weather, conservation measures, mitigation techniques, ventilation and radon levels.

48799 **Radon overview.** Brennan, T.M. (Camroden Associates, Inc., Rome, NY (USA)). pp. 47 of Affordable comfort III program. Action-Housing, Inc., Pittsburgh, PA (US) (1988). (CONF-8811288–: 3. affordable comfort, Pittsburgh, PA (USA), 29 Nov - 1 dec 1988).

This tutorial presents the history of the radon industry, currently-used testing and mitigation techniques and future private industry and governmental plans. The significance of radon for homeowners, realtors and the construction industry is discussed. As a result of this tutorial, participants will: (1) Know how we became aware of the radon problem; (2) Learn what private industry and government officials are doing about it; (3) Understand the implications of radon for homeowners, realtors, builders and weatherization professionals.

48800 **Radon I: Sources and assessment.** Clarkin, M.E. (Camroden Associates, Inc., Rome, NY (USA)). pp. 50 of Affordable comfort III program. Action-Housing, Inc., Pittsburgh, PA (US) (1988). (CONF-8811288–: 3. affordable comfort, Pittsburgh, PA (USA), 29 Nov - 1 dec 1988).

This tutorial discusses radon sources and the dynamics of radon entry into the home. A step-by-step path through the process of

screening and follow-up testing interpretation of test results, and possible solutions is of interest to contractors new to the field and to those concerned with the procedures required to ensure that correct actions are taken. As a result of this tutorial, participants will: (1) Understand sources of radon and how it gets into homes; (2) Know steps to take to check for radon in homes; (3) Have a basic knowledge of various mitigation techniques.

48801 Radon II: Mitigation. Clarkin, M.E. (Camroden Associates, Inc., Rome, NY (USA)). pp. 58 of Affordable comfort III program. Action-Housing, Inc., Pittsburgh, PA (US) (1988). (CONF-8811288--: 3. affordable comfort, Pittsburgh, PA (USA), 29 Nov - 1 dec 1988).

This tutorial explains the methods and equipment used to determine the proper mitigation strategy. Various diagnostic testing and mitigation techniques are presented. This tutorial is designed for those who want to do their own mitigation work, or the contractor who wishes to enter the relatively new field of radon mitigation. As a result of this tutorial, participants will: (1) Understand the techniques used to determine which specific mitigation technique should be used; (2) Know what equipment is required; (3) Understand the theory behind the use and installation of various mitigation techniques.

48802 Electricity: Getting more with less. Hirst, E. (Oak Ridge National Lab., TN (USA)). *Technology Review (USA),* 93(5): 32-40 (Jul 1990).

This paper presents a historical overview of electricity consumption in the U.S. from the 1950's to the present. The author focuses on the environmental factors which call for increased energy conservation measures in the future.

3202 Transportation

Refer also to citation(s) 48744, 48845

48803 (PB-90-246802/XAB) **Redesigning local transportation service for improved suburban mobility: The problem of accessibility for the elderly and low-income residents. Final report, 1 January 1989-31 May 1990.** Nwokolo, B.N. Grambling State Univ., LA (USA). Dept. of Industrial and Engineering Technology. May 1990. 139p. Contract UMTA-LA-11-0050. Source: NTIS, PC A07/MF A01.

The purpose of the research was to investigate the problem associated with suburban mobility and accessibility of transportation services for the elderly, the handicapped, and the socioeconomically disadvantaged residents of the tri-cities of Grambling, Ruston, and Monroe, all of which are cities located within Northeast Louisiana.

3203 Industrial and Agricultural Processes

Refer also to citation(s) 48072, 48185, 48263, 48491, 48750, 48771, 48781, 48830, 49180, 49191, 49591, 49613, 50088

48804 (CIPEC-CE03146) **Energy accounting manual.** Canadian Industry Program for Energy Conservation, Ottawa, ON (Canada). [1990]. vp. (CE-03146). Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

The objective of this manual is to assist companies in their efforts to organize and implement a proper energy auditing system which will provide managers with the necessary information to implement and monitor an effective energy management program. The manual is intended to provide a standard energy auditing format and gives step-by-step procedures on setting up the energy information reporting centre, selecting a valid production unit which provides the best energy auditing results, monitoring and recording energy use, measuring production, relating energy use to production, comparing current performance to that of a reference year, and identifying any reasons for changes in energy intensity. Calculations of energy savings are also included. An advanced section of the manual aids in adjusting audit results to take into account such factors as production disruptions, plant expansions, new equipment or products, and changes in raw materials or energy sources. 2 figs.

48805 (CONF-901109-14) **Study of asymmetric supersonic jet flow for ejectors.** Ho, C.M. (University of Southern California, Los Angeles, CA (USA). Dept. of Aerospace Engineering); Knoke, G.S.; Geller, E.W.; Liu, H.T.; Jou, W.H.; Chen, F.C.; Murphy, R.W. Oak Ridge National Lab., TN (USA). [1990]. 13p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers; Dallas, TX (USA); 25-30 Nov 1990. Order Number DE90015598. Source: NTIS, PC A03/MF A01 - OSTI.

An asymmetric subsonic jet nozzle with a small aspect ratio can entrain a mass several times higher than a circular jet can entrain in a low subsonic flow. In this study, we extend the Mach number of the jet to 2.5. The advantage an asymmetric jet has over a circular jet in enhancing mass transfer still exists in the supersonic range. The main objective of this study is to explore the possibility of applying the asymmetric jet to a supersonic ejector with pressure build-up. The wall confinement was found to have a strong effect on the entrainment.

48806 (DOE/CH/10093-78) **Evaluation of a high-temperature burner-duct-recuperator system: A technical case study.** Solar Energy Research Inst., Golden, CO (USA); Energetics, Inc., Columbia, MD (USA). Jul 1990. 13p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093 ;AC01-87CE40762. Order Number DE90000366. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The US Department of Energy's (DOE) Office of Industrial Technologies (OIT) sponsors research and development (R&D) to improve the energy efficiency of American industry and to provide for fuel flexibility. OIT has funded a multiyear R&D project by the Babcock & Wilcox Company (B&W) to design, fabricate, field test, and evaluate a high-temperature burner-duct-recuperator (HTBDR) system. This ceramic-based recuperator system recovers waste heat from the corrosive, high-temperature (2170°F) flue gas stream of a steel soaking pit to preheat combustion air to as high as 1700°F. The preheated air is supplied to a high-temperature burner. The B&W R&D program, which is now complete, involved several activities, including selecting and evaluating ceramic materials, designing the system, and developing and evaluating the prototype. In addition, a full-scale unit was tested at a B&W steel soaking pit. The full-scale system consisted of a modular single-stage ceramic recuperator, a conventional two-pass metallic recuperator, a high-temperature burner, fans, insulated ducting, and associated controls and instrumentation. The metallic recuperator preheated combustion air to about 750°F before it passed to the ceramic module. This technical case study describes the DOE/B&W recuperator project and highlights the field tests of the full-scale recuperator system. The document makes results of field tests and data analysis available to other researchers and private industry. It discusses project status, summarizes field tests, and reviews the potential effects the technology will have on energy use and system economics. 8 figs., 3 tabs.

48807 (EUR-11888) **Absorption heat pumps: Proceedings of a workshop.** Zegers, P. (Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation); Miriam, J. (eds.). Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation; British Gas PLC, London (UK). 1988. 444p. Sponsored by Commission of the European Communities. (CONF-8804332--: Absorption heat pumps workshop, London (UK), 12-14 Apr 1988). Source: NTIS (US Sales Only), PC A19/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 37.50.

This document contains papers presented to a workshop in London during April 12 to April 14, 1988. The title of the workshop was absorption heat pumps. Specific topics covered were: fluids and analytical studies; adsorption and periodic cycles; R&D activities; absorption with vapour compression; heat pump developments; heat transfer and other cycles; and heat and mass transfer. Each paper will be individually cataloged. (FSD)

48808 (EUR–12046) **Energy efficiency in industrial processes: Future R and D requirements: Proceedings of the CEC seminar.** Pilavachi, P.A. (ed.). Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1988. 385p. Sponsored by Commission of the European Communities. (CONF-8806393–: CEC contractors' meeting on energy efficiency in industrial processes, future R&D requirements, Brussels (Belgium), 30 Jun - 1 jul 1988). Source: NTIS (US Sales Only), PC A17/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 35.

Energy is a limited resource. The commission is therefore anxious to help industries improve the efficiency with which they use it. The primary energy consumption of industry in the community is about 400 mtoe (millon tonnes oil equivalent) each year, which is more than 40% of the community's total primary energy consumption. The process industries account for 75% of this amount, the largest consumers being the chemicals and steel industries. The next non-nuclear energy R&D Programme, entitled JOULE (1989–1991), covers the following three areas: rational use of energy, energy from fossil sources and renewable energies. In preparing for the "rational use of energy" component of this programme, the commission has just carried out a survey to establish what strategic R&D is required to provide a technical foundation for future improvements in the energy efficiency of the process industries. The results of this survey have been examined by the community's leading experts in this field at a special seminar: Energy Efficiency in Industrial Processes – Future R&D Requirements which was held in Brussels on 30 June and 1 July, 1988. There were 124 participants of which around forty came from universities and forty from industry. The seminar which is described herein helped the commission to define what research is required, what the main areas of application and energy efficiency benefits are likely to be, and what is the strength of the community's current research position in this field. The following specific areas were discussed: industrial units; energy and process system models; and instrumentation and control sensors. Each report will be individually cataloged.

48809 (EUR–12246) **Industrial processes: Proceedings of a contractors' meeting.** Pilavachi, P.A. (ed.) (Commission of the European Communities, Brussels (Belgium)). Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation; Commission of the European Communities, Brussels (Belgium). 1989. 299p. Sponsored by Commission of the European Communities. (CONF-8806490–: CEC contractors' meeting on industrial processes, Brussels (Belgium), 29 Jun 1988). Source: NTIS (US Sales Only), PC A13/MF A01; OSTI; Office of Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 25.

The European Community has been involved in the field of energy since its formation, much of the early activity being concerned with coal and nuclear power, including fusion. Within the context of energy conservation R&D, four successive Programmes have been established. The first Non-Nuclear Energy R&D Programme, launched in 1975 with a planned duration of 4 years, was followed by similar Programmes in 1979 and 1985. A fourth Non-Nuclear Energy R&D Programme, entitled "JOULE" (Joint Opportunities for Unconventional or Long-term Energy Supply) is approved for launch in 1989. Over 40% of the total primary energy in the community is used by industry, totaling in excess of 350 million tonnes of oil equivalent (mtoe) per annum. Typically half of this total, i.e. 170 mtoe/annum, is used in the form of process heat. Energy saving opportunities of considerable magnitude exist for operations in industry which tend to be dedicated to particular processes. The aim of this meetings and these reports was to enable contractors of the Commission to report on the progress of their projects to Commission personnel and its experts, as well as to other contractors participating in the Programme. The meeting also allowed discussion of the projects which benefitted their future direction. Each report will be individually cataloged.

48810 (EUR–12289) **Multi-stage solid absorption heat transformers for recovery of industrial waste heat: Final report.** Worsoee-Schmidt, P. (Danmarks Tekniske Hoejskole, Lyngby (Denmark). Refrigeration Lab.); Soerensen, K. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. 41p. Sponsored by Commission of the European Communities. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg.

The aim of the project has been to investigate the feasibility of using solid-absorption heat pumps and heat transformers for upgrading industrial waste heat to temperatures at which it can be used for process purposes. In particular systems utilizing ammonia as the working substance and metal halides as absorbents seem to offer promising prospects. 15 figs., 3 tabs.

48811 (FRNC-TH–3645) **Modelization and PC-based control of a distillation column - heat pump system.** Hannane, F. Institut National des Sciences Appliquees (INSA), 69 - Villeurbanne (France). Oct 1989. 135p. (In French). Order Number DE91701159. Source: NTIS (US Sales Only), PC A07/MF A01.

A partial top reflux column coupled to a heat pump is described and analyzed. The different fluids (elementary bodies and compounds) are modelized and a sequential data collection program is developed for the experimental test system. A code is also developed that gives directly the thermodynamic cycle of the Freon in the MOLLIER enthalpy-pressure diagram. The various components of the system (distillation column, heat exchangers, pressure reducing valve, compressor) are modelized and validated with experimental results.

48812 (OAF/AED–89-6508) **Sealing and insulating specific areas of bulk tobacco kilns: Final report.** Hooren, D.L. Van. Ontario Ministry of Agriculture and Food, Delhi, ON (Canada). Agricultural Energy Centre. Apr 1989. 17p. (MICROLOG–90-03936). Source: PC Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, CAN N1H 6N1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The energy and cost effectiveness of applying a 25 mm thickness of polyurethane foam to the roof, furnace wall, sheet metal partition above the furnace and the outer perimeter of the lower plenum of 5 bulk tobacco kilns in Ontario was evaluated. The cost of the polyurethane foam application was $600 per kiln. As compared to 5 unmodified kilns at the same site, a natural gas saving of 16% was realized. The simple payback period for the insulation retrofit would be about 7 curing seasons. If the bulk kilns had been fuelled by propane, the simple payback period would be about 4 curing seasons. In addition, the insulation retrofit did not affect the quality of cured tobacco, and the time required to condition tobacco in the insulated kilns was reduced by an average of 4 hours compared to the unmodified kilns. 5 figs., 2 tabs.

48813 (OMAF/AE–89-01) **Reduce grain drying costs by recovering lost heat.** Farm energy facs, No. 89-01. Ontario Ministry of Agriculture and Food, Delhi, ON (Canada). Agricultural Energy Centre. 1989. 4p. (CE–03133). Source: Ontario Agriculture and Food, Communications Branch, 801 Bay St, 12th Floor, Toronto, ON, CAN M7A 2B2. Prices: PRICES UPON REQUEST.

Case studies from 3 Ontario farms are presented to demonstrate the advantages of heat recovery in drying corn. A heat exchanger costing $15,000 was installed to recover heat from the exhaust air at a 300,000 bushel-per-year operation. The heat so recovered is transferred to the burner feed air. Natural gas fuel expenses have been reduced by over $10,000 per year. The 2 other farms are using warm-air recirculation systems, which are significantly less expensive to set up. At another 300,000 bushel-per-year opreation, exhaust air is taken from the bottom third of a twin-column dryer and ducted back to the burner. This recirculator saves an average of 120 liters of propane per hour, a reduction in fuel consumption of 26%, for a minimal installation cost. At a 30,000 bushel-per-year operation, a plywood divider and duct system costing $300 was built to take dry, warm air from the corn cooler back to the dryer fan inlet. The system saves more than $300 in fuel costs every year. 6 figs.

48814 (OMAF/AE–89-02) **Heat pumps gain popularity solving more farm needs.** Farm energy facs, No. 89-02. Ontario Ministry of Agriculture and Food, Delhi, ON (Canada). Agricultural Energy Centre. 1989. 4p. (CE–03134). Source: Ontario Agriculture and Food, Communications Branch, 801 Bay St, 12th Floor, Toronto, ON, CAN M7A 2B2. Prices: PRICES UPON REQUEST.

Case studies are presented from 3 Ontario farms to demonstrate the uses and advantages of heat pumps in various types of farming operations. In an insect breeding unit at an agricultural college, heat pumps are used to maintain strict temperature control, using water from a municipal drain as the year-round heat source. At a commercial greenhouse growing alstroemerias and freesias, heat pumps are used to cool the soil and control its temperature to stay below 15°C, in order to ensure that those plants will produce flowers. Using the heat pumps enables a nonstop year-round harvest, which would not otherwise be possible. At a 1,200-head hog finishing operation, excess heat from the hog barns is tapped via coiled plastic tubing and upgraded with a heat pump, in order to heat the farmhouse. The heat pump has reduced home heating costs by about $1,100 annually. 5 figs.

48815 (OMAF/AE–89-03) **Heat exchangers reduce costs, provide better livestock environment.** Farm energy facs, No. 89-03. Ontario Ministry of Agriculture and Food, Delhi, ON (Canada). Agricultural Energy Centre. 1989. 4p. (CE–03135). Source: Ontario Agriculture and Food, Communications Branch, 801 Bay St, 12th Floor, Toronto, ON, CAN M7A 2B2. Prices: PRICES UPON REQUEST.

By using heat exchanger technology, farmers can ventilate their barns at proper rates and at the same time spend less for supplemental heating. These and other advantages of heat exchangers are demonstrated through case studies from Ontario farms. At a swine finishing operation, heat exchangers saved enough on electricity bills to pay for themselves in 3 years. In addition, it was found that midwinter ventilation rates could be kept higher, dust and odors were minimized, relative humidity was kept at 60%, and the animals were healthier. A 14,000-bird poultry operation achieved a similar payback through the use of heat exchangers on each floor of a roaster barn. Health and productivity of the birds were also improved. Heat exchangers were credited with keeping air quality high and animal bedding dry in a calf nursery; enough was saved on the electric heating bill to pay for the heat exchanger in just one year. At another pig farm, a wall-type heat exchanger was built into a new barn during construction. Cold incoming air travels 100 feet along one wall of the barn through plastic tubes, where it picks up heat from exhausted air travelling outside of the tubes in the opposite direction. It has been found that in winter, incoming air has picked up enough heat to eliminate the need for supplementary heating in much of the barn. Ventilation rates can be maintained to eliminate cold drafts, fogging, and odors. The system has paid for itself in about 4 years. 4 figs.

48816 (OMAF/AE–89-04) **Biomass fuels proven dependable at work on Ontario farms.** Farm energy facs, No. 89-04. Ontario Ministry of Agriculture and Food, Delhi, ON (Canada). Agricultural Energy Centre. 1989. 4p. (CE–03136). Source: Ontario Agriculture and Food, Communications Branch, 801 Bay St, 12th Floor, Toronto, ON, CAN M7A 2B2. Prices: PRICES UPON REQUEST.

Three examples are presented to show that biomass sources can provide a realistic and cost-effective fuel supply for agricultural operations in Ontario. Two greenhouse operators both fuel their boilers with biomass, one with sawdust from a cabinetmaker, and the other with hogged wood waste bought from a disposal company. Both have cut fuel costs by over 50%. Another farmer has been developing a system to burn corn cobs, using a specially designed biomass burner, in order to produce heat for corn drying. This system was inspired by the fact that there is enough heat potential in the cobs produced by a single acre of corn to dry 2 acres grain yield. Initial trials in the early 1980s showed some problems such as insulation breakdown in the combustion chamber. A number of prototypes were designed and modified until 1983 when a commercially viable system was obtained. A cob collection system was also developed. However, falling corn prices and lower fuel prices have temporarily reduced the attractiveness of this system to farmers. Taking the above examples into account, some criteria are given for evaluating the feasibility of using biomass fuels on the farm. 5 figs.

48817 (OMAF/AE–89-05) **Insulation cuts curing costs, offers better kiln control.** Farm energy facs, No. 89-05. Ontario Ministry of Agriculture and Food, Delhi, ON (Canada). Agricultural Energy Centre. 1989. 4p. (CE–03137). Source: Ontario Agriculture and Food, Communications Branch, 801 Bay St, 12th Floor, Toronto, ON, CAN M7A 2B2. Prices: PRICES UPON REQUEST.

The cost of curing fuel represents about 8% of total operating costs for flue-cured tobacco production in Ontario. This percentage can be reduced significantly by proper insulation of tobacco kilns, according to the examples presented. Insulation can save costs in 2 ways: by reducing heat losses, and by sealing kilns and preventing leakage. Two case studies show that the fuel savings are in the range of 17-20%, and that there are additional advantages: the curing process is shorter, kiln temperature and humidity can be controlled more precisely, and as a consequence, product quality is improved. A number of guidelines are presented for insulating and sealing kilns. Polyurethane is recommended as an insulating material since it can be applied as a foam, gives a good seal, adheres well to kiln surfaces, and does not break down under the typical temperature and humidity conditions found in kilns. 5 figs.

48818 (OMAF/AE–89-06) **Versatility of tobacco kilns eases shift to alternate crops.** Farm energy facs, No. 89-06. Ontario Ministry of Agriculture and Food, Delhi, ON (Canada). Agricultural Energy Centre. 1989. 4p. (CE–03138). Source: Ontario Agriculture and Food, Communications Branch, 801 Bay St, 12th Floor, Toronto, ON, CAN M7A 2B2. Prices: PRICES UPON REQUEST.

The decline in the Ontario tobacco market has caused many farmers to use tobacco kilns for other uses. In these kilns, heating and air flow rates can be adjusted to provide a wide range of temperature, aeration, and humidity conditions. Three case studies demonstrate the versatility of tobacco kilns and the possibilities of reducing energy costs involved in kiln operation. Minor modifications enabled a farm near Brantford to cure a ginseng crop in addition to tobacco. The kiln was capable of reducing the 70% moisture in the ginseng roots to the optimum dryness while producing a product of good color and quality. For curing a crop of sweet potatoes, a tobacco kiln was modified by replacing the kiln's fan unit with a lower power model, to accommodate the reduced airflow requirements for drying the potatoes. In a dual peanut/tobacco operation, the tobacco is harvested and cured first, and then the kilns are readily modified to cure peanuts. The kilns are operated such that about 85% of the air fed to the burner is recirculated air from the curing compartment. This recirculation cuts fuel use by up to 50%. 4 figs.

48819 (OMAF/AE–89-1504) **A study of the impact of no-till on tractor fuel cost vs crop returns, as affected by various no-till planter modifications.** Lobb, D. Ontario Ministry of Agriculture and Food, Delhi, ON (Canada). Agricultural Energy Centre. Feb 1989. 43p. (MICROLOG–90-03937). Source: PC Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, CAN N1H 6N1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Fuel use as a factor of crop production costs is a useful measure of efficiency in the food production system. Tillage for crops is a heavy user of fuel. The technology is generally available to make corn and soybean production a practical option without primary tillage. 'No-Till' is such an option. To fine tune the system, No-Till planter attachments were evaluated for effect in field tests at an Ontario farm. Plant stand and crop yield were improved when a 20 cm wide strip was cleared of crop residue when corn followed corn. A planter attachment combination was selected which tilled a band of soil 8 cm wide and 15 cm deep, thus ensuring good seed and fertilizer placement. Varying amounts of tillage affected corn growth rate, but had insignificant effect on plant development or crop yield in trials where the balance of the crop production technology package was selected from the best currently available. With the use of conventional tillage to provide benchmark data, No-Till corn and soy crop yields and production costs (up to harvest) were tabulated over a 3-year period. Results indicate herbicide, fertilizer, seed and other crop costs to be similar for both Conventional- and No-Till.

Labour cost for No-Till was 45% of that for Conventional-Till, while machine overhead and maintenance cost was 48%. Average No-Till fuel use for corn and soys was 4.68 l/acre versus 14.76 l/acre for Conventional-Till. Of particular interest is that $1.00 worth of fuel produced $51.71 worth of Conventional-Till corn/soys and $170.21 worth of No-Till corn/soys, an efficiency improvement of more than three times. 9 refs., 5 figs., 13 tabs.

48820 (OMAF/AE–89-2301) **Irrigation pumping plant evaluation: Interim report.** Hooren, D.L. Van. Ontario Ministry of Agriculture and Food, Delhi, ON (Canada). Agricultural Energy Centre. May 1989. 16p. (MICROLOG–90-03938). Source: PC Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, CAN N1H 6N1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

On-farm irrigation pumping tests were conducted to determine the fuel efficiency and fuel consumption cost of power units operating on diesel, propane, natural gas, or electricity. The tests were performed at 15 Ontario tobacco farms. Because of the differences between the different pumping arrangements, fuel efficiencies of each pumping plant were calculated from the relationship between the useful work produced by the pump and the amount of fuel consumed to produce this work. Standards for pumping plant efficiencies established by the University of Nebraska were used as a guide to determine whether the pumping plants monitored were operating at peak fuel efficiency. Estimates of the fuel savings that could be achieved by improving the efficiency to the Nebraska standard were determined, as applicable. In addition, potential fuel savings resulting from switching fuel sources were examined. It was found that most of the pumping plants were operating below the Nebraska standard. Based on 1988 fuel prices, improvement to the standard would result in fuel cost savings of $2.29-6.90 for diesel, $0.95-4.19 for electric, $3.76-13.87 for gasoline, and $2.29-2.97 for natural gas, in the case of applying 25 mm of water to 1 hectare. For the same amount of work performed, replacing gasoline-fuelled units with alternately fuelled units would result in cost savings (not including capital costs of conversion to the alternate fuel) of $3.76-5.43 for propane, $7.31-10.55 for natural gas, $5.12-8.49 for diesel, and $7.57-12.57 for electricity. 7 tabs.

48821 (OMAF/AE–89-5103) **Methods to utilize tobacco kilns for curing (drying) and/or storage of alternate crops: Interim report. 1988 year.** Hooren, D.L. Van; Ratavicius, A.J. Ontario Ministry of Agriculture and Food, Delhi, ON (Canada). Agricultural Energy Centre. Mar 1989. 94p. (MICROLOG–90-03942). Source: PC Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, CAN N1H 6N1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The decline in demand for flue-cured tobacco in Ontario has led to diversification into other crops on some tobacco farms. Some of these crops require curing, drying, and/or storage, and conventional equipment for carrying out such processes involves high capital costs. To avoid these costs, many producers would like to be able to modify their existing equipment in order to process these new crops. In this study, methods to utilize tobacco kilns for conditioning of crops other than tobacco were investigated. Results are presented for the following crops: popcorn, ginseng, peanuts, onions, dried flowers, and sweet potatoes. The conditions required to achieve satisfactory product quality and the required energy consumption are noted. The overall results indicate that tobacco kilns can be modified to condition the crops studied provided that the appropriate air conditions can be attained in the kilns. For peanuts, field curing is not possible because of the frost danger in the harvest season, thus peanut curing in Ontario is more energy intensive than in the USA. The most energy efficient method for curing peanuts was found to be batch curing in bulk kilns. Peanut quality did not appear to be affected by the air relative humidity or the air flow rate. 19 refs., 27 figs., 21 tabs.

48822 (OMAF/AE–89-5104) **Handling and curing peanuts in modified tobacco bins.** Hooren, D.L. Van. Ontario Ministry of Agriculture and Food, Delhi, ON (Canada). Agricultural Energy Centre. Jun 1989. 23p. (MICROLOG–90-03941). Source: PC Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, CAN N1H 6N1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A study was conducted to determine if tobacco curing bins could be modified for handling and curing of Ontario-grown peanut pods in tobacco kilns. The applicability of using this proposed handling/curing method was evaluated by determining the degree of modifications necessary, the product handling requirements, the differences in the curing process resulting from peanut pods being contained in bins rather than loose on the kiln floor, peanut quality, and the energy required for curing. The test results showed the potential of modified tobacco bins for the handling and curing of peanuts. However, if air is allowed to channel around the bins during curing, the drying rate will be slow, energy consumption will increase, and peanut quality will be lower. An improved method to prevent curing air from channelling around the bins needs to be devised before the bin method of handling and curing of peanuts can be recommended to growers. 8 figs., 4 tabs.

48823 (PB–90-247214/XAB) **Low-cost cogeneration system controller development. Final report, May 1988–July 1989.** Sass, W.L. Second Wind, Inc., Somerville, MA (USA). 19 Apr 1990. 106p. Contract GRI-5087-293-1644. Source: NTIS, PC A06/MF A01.

Work performed included market research and software and hardware development. The objective of the project was to develop a relatively low cost electronic controller for small, packaged cogeneration systems that would have sophisticated features of larger controller and energy management systems. Market research revealed that availability of a sophisticated, low cost controller would not significantly effect system marketability. Research was directed towards developing a subset of the original controller that would be more useful to the industry in the short term. Technical marketing, hardware and software development proceeded until it was decided that the emerging product, a smart energy transducer, would have broad industrial applicability, but bring the contractor far afield of its present business.

48824 (PB–90-253220/XAB) **Recycling of electric-arc-furnace dust.** Sresty, G.C. IIT Research Inst., Chicago, IL (USA). May 1990. 73p. Source: NTIS, PC A04/MF A01.

Electric arc furnace (EAF) dust is one of the largest solid waste streams produced by steel mills, and is classified as a waste under the Resource Conservation and Recovery Act (RCRA) by the U.S. Environmental Protection Agency (EPA). Successful recycle of the valuable metals (iron, zinc, and lead) present in the dust will result in resource conservation while simultaneously reducing the disposal problems. Technical feasibility of a novel recycling method based on using hydrogen as the reductant was established under this project through laboratory experiments. Sponge iron produced was low in zinc, cadmium, and lead to permit its recycle, and non-toxic to permit its safe disposal as an alternative to recycling. Zinc oxide was analyzed to contain 50% to 58% zinc by weight, and can be marketed for recovering zinc and lead. A prototype system was designed to process 2.5 tons per day (600 tons/year) of EAF dust, and a preliminary economic analysis was conducted. The cost of processing dust by this recycling method was estimated to be comparable to or lower than existing methods, even at such low capacities.

48825 (PNL-SA–17985) **Planning for future waste storage and transport requirements.** Holter, G.M.; Shay, M.R.; Stiles, D.L. Pacific Northwest Lab., Richland, WA (USA). Mar 1990. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. (CONF-900676–12: 83. annual meeting and exhibition of the Air and Waste Management Association, Pittsburgh, PA (USA), 24-29 Jun 1990). Order Number DE90016357. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Waste management is becoming an ever more important topic. Increasing regulatory requirements are being placed on waste management activities. There is also an expanding public awareness of and attention to waste management topics, with increased public participation in decisions affecting waste management. Although much of the current waste management focus is on remediating problems resulting from past practices, we are also faced with the

significant challenge of planning for management of current and future wastes. This planning must take into account the storage and transport capabilities that will be required to properly manage the wastes, from the point of generation through to their ultimate disposal. Planning to provide adequate and appropriate storage and transport capabilities for wastes to be generated or received in the future is a difficult but critical undertaking. Storage and transport capabilities need to be provided in appropriate amounts and types to match the amounts and characteristics of the wastes to be handled. For example, wastes containing flammable components are required to have different storage conditions that other types of hazardous wastes, and are required to be kept separate. Storage overcapacity for flammable wastes will generally not substitute for undercapacity for wastes containing, for example, acute toxins. There are a number of similarly exclusive requirements that severely limit options for storage of multiple waste types. This paper examines several key factors in developing reliable projections of future waste storage and transport requirements and subsequently using these projections to develop specific plans. The paper then discusses application of these factors in the development of solid waste projection capabilities for a large, complex facility with a number of distinct waste types. 1 fig., 1 tab.

48826 (VTT-SYMP–102, pp. 259-274) **Utilization of resources of the wood pulping industry - a holistic view.** Gullichsen, J. (Helsinki Univ. of Technology, Otaniemi (Finland)). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-8806445–: Seminar on non-waste technology, Espoo (Finland), 20-23 Jun 1988). In *Non-waste technology: Volume 1.* Order Number DE90728202. Source: Valtion Teknillinen Tutkimuskeskus, Espoo, Finland.

The author describes in his presentation the present situation of Finnish pulping industry, the production capacity of the industry, as well as power demand as a function of production. The need and utilization of electric power and fuels, and the future trends of pulping methods are also viewed. The author also estimates the trends of power demand and demand of raw materials in the near future, as well as the emissions from the Finnish pulping industry, and reviews also the possible ways to improve the efficiency of the industry.

48827 (VTT-SYMP–102, pp. 249-257) **Non-waste technology - a challenge to biotechnology.** Linko, M. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Biotekniikan Lab.). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. (CONF-8806445–: Seminar on non-waste technology, Espoo (Finland), 20-23 Jun 1988). In *Non-waste technology: Volume 1.* Order Number DE90728202. Source: Valtion Teknillinen Tutkimuskeskus, Espoo, Finland.

There are four alternative ways for biotechnology to meet the non-waste technology. Biotechnology could take care of some difficult wastes and pollutants formed in the existing chimney industry, biotechnology could be included in one or more stages in the existing processes to prevent or to reduce the formation of harmful wastes. Biotechnology could also offer a new process competing favourably with the existing industry, and biotechnology could utilize renewable materials instead of the present use of non-renewable resources. The author is discussing in his presentation the reasons and possibilities to utilize the applications of biotechnology in non-waste technology in process industry, especially in pulp and paper industry and food and feed industry.

3206 Municipalities and Community Systems

Refer also to citation(s) 48436, 48598, 48784, 48802, 48825

48828 (EUR–12099) **Vester Nebel combined collective heat supply system: Demonstration project: Final report.** Oersted, H. (Esbjerg Kommune (Denmark). Forsyningsvirksomhederne); Majland, O. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. 48p. Sponsored by Commission of the European Communities. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 5.

The Vester Nebel project is a pilot and demonstration project dealing with a collective district heating supply to small communities. The heat production is based mainly on local renewable energy sources and is utilized as a heat supply to the Vester Nebel village in the municipality of Esbjerg. The demonstration project began in the spring of 1983. The plant was brought into operation two years later and a comprehensive monitoring programme, concluded in May 1987, has been carried out. The project was organized by a supervisory group that included representation of the owner, the consultants, the Danish Energy Agency, the inhabitants of Vester Nebel and the steering groups of the National Research Programmes for Solar Energy, Heat Pumps and District Heating. This final report was prepared by Mads Lange, Technological Institute, Denmark, Dept. of Energy Technology. The supervision group has given valuable support. 27 figs.

48829 (EUR–12166) **Economic utilization of landfill gas from small and medium-sized waste dumps: Demonstration project: Final report.** Dehli, M. (Energie-Versorgung Schwaben AG, Stuttgart (Germany, F.R.)); Erb, P.; Luik, K.O.; Reinicke, B. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation; Energie-Versorgung Schwaben AG, Stuttgart (Germany, F.R.). 1989. 48p. (In English, German). Sponsored by Commission of the European Communities. Contract No. BM/001/84-DE. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 5.

The formation of landfill has containing methane is a result of high compression in waste dumps, inhibiting the ingress of oxygen into the core of the dump. The following processes takes place inside the dump core: An initial aerobic phase lasting a few months is followed by an anaerobic phase lasting for between 20 and 30 years, during which landfill gas containing methane forms. The peak generation of landfill gas occurs about one year after waste is deposited. Thereafter, gas generation decreases exponentially. Landfill gas occurs as a result of the micro-biochemical decomposition of organic carbon contained in domestic or similar waste. The main constituents of landfill gas are methane (CH_4) and carbon dioxide (CO_2). Landfill gas also contains small quantities of nitrogen (N_2) and oxygen (O_2) as well as traces of halogenated hydrocarbons (fluorocarbons and chlorinated hydrocarbon compounds) and hydrogen sulphide (H_2S). The quantity of gas mainly depends on the type of refuse, its quantity and environment inside the waste dump (humidity, temperature, toxic constitutents). In the majority of waste dumps the degree of extraction expressed as the ratio between the gas quantity extracted and the gas quantity produced is between 30 and 50%. The purpose of this field trial was to verify whether the gas occurring could not be simply flared off without being used for energy generation or whether is could be utilized for commercial power generation in a landfill gas power plant. 3 refs., 4 figs., 3 tabs.

48830 (MRAC–90-03425) **Recycling: What you had to say. A summary of your comments at the open houses.** Manitoba Recycling Action Committee, Winnipeg, MB (Canada). [1989]. 6p. (MICROLOG–90-03425). Source: PC Manitoba Legislative Library, 200 Vaughan St., Winnipeg, MB, CAN R3C 1T5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The Recycling Action Committee was created to develop a recycling strategy for Manitoba for the 1990s. The province has a stated objective of reducing solid wastes by 50% by 2000. During October 1989, 500 Manitobans attended the Committee's 8 open houses and a series of mini-presentations. This report provides a synopsis of the comments at the open houses. Under each topic discussed is a general statement of its subject and a selection of suggestions from the participants. Topics covered include waste reduction; the use of alternative products; what to do with paper, newspapers, and soft drink containers; composting; methods of collection; means of motivating and educating the public; available

and future markets; producer responsibility; fiscal factors; and the Committee's mandate.

48831 (NEI-FI–114) **Development of an energy management system.** Liimatainen, K.-R.; Saukkoriipi, L.; Makkonen, S. JP-International, Helsinki (Finland). 1989. 112p. (In Finnish). Project KTM-12/881/85. Source: JP-International, Helsinki, Finland.

Vantaan Saehkoelalitos Oy decided in 1985 to acquire an enegy management system for short time optimisation of production and purchase costs of electricity and district heating. The energy system of Vantaan Saekoelaitos Oy and Kupari Consulting Oy decided to jointly develop it with financial backing from the Ministry of Trade and Industry. The programming was finalised by the business unit JP-Energy within JP-International Oy. The potential for cost savings when using such a system has been estimated by Technical Research Centre of Finland to be 3% of the energy costs, which in the case of Vantaa Saehkoelaitos Oy would make 4 MFIM annually. The energy management system of Vantaa Saehkoelaitos Oy calculates once an hour the operation guidelines of their production facilities for the following two days. The system can also be applied to the simulation of operating conditions which can be freely chosen. The system consists of the following main units: Forecasting of heat and power consumption (FLOATER), Simulation of own production facilities, Optimisation of own production and purchase (REALOPT), Simulation of heat distribution (NETSIM).

48832 (OE/RT–90-03626-Vol.2, pp. 394-400, Paper E6) **Awareness and participation levels in high-rise apartment building recycling programs.** Maclaren, V.W. (Dept. of Geography, Univ. of Toronto, ON (Canada)). Ontario Ministry of the Environment, Toronto, ON (Canada). Research and Technology Branch. 1989. (CONF-8911230–: Environmental research: technology transfer conference, Toronto (Canada), 20-21 Nov 1989; MICROLOG–90-03625). In *Proceedings [of the] Environmental research: Technology transfer conference: Volume 2. Liquid and solid waste, analytical methods, environmental socio-economics.* Source: PC Publications Ontario, 880 Bay St, 5th Floor, Toronto, ON, CAN M7A 1N8; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $6.00 CAN; MF $10 CAN.

This study is the second of a two-stage study on apartment building recycling which examines the factors that affect resident awareness and participation levels in existing apartment building recycling programs. A survey was designed to examine the impact of socio-economic characteristics of the population and the convenience of the program on participation levels. Two types of building tenancy were selected: rental and condominium. Results indicate that the operational characteristics of a program (ie. convenience, number of materials) do not appear to have a significant effect on participation levels. It appears that the single most important factor affecting participation levels is effective initial and ongoing publicity for high-rise apartment building recycling programs. This study has shown that participation levels in apartment building recycling programs can achieve levels just as high, or even higher, than those in curbside collection programs. 5 refs.,

48833 (SERI/TP–231-3622) **Assessment of municipal solid waste for energy production in the western United States.** Goodman, B.J.; Texeira, R.H. Solar Energy Research Inst., Golden, CO (USA). Aug 1990. 95p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE90000361. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Municipal solid waste (MSW) represents both a significant problem and an abundant resource for the production of energy. The residential, institutional, and industrial sectors of this country generate about 250 million tons of MSW each year. In this report, the authors have compiled data on the status of MSW in the 13-state western region, including economic and environmental issues. The report is designed to assist the members of the Western Regional Biomass Energy Program Ad Hoc Resource Committee in determining the potential for using MSW to produce energy in the region. 51 refs., 7 figs., 18 tabs.

3209 Education and Public Relations

48834 (DOE/ER–0454) **Guide for the preparation of proposals for the pre-freshman enrichment program, PREP, 1991.** USDOE Office of Energy Research, Washington, DC (USA). University and Industry Programs Div. Aug 1990. 39p. Sponsored by U.S. DOE Energy Research. Order Number DE90015964. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document describes preparations for a pre-freshman enrichment program sponsored by the US Department of Energy (USDOE). The purpose of the "PREP" program is to encourage women and minorities to enter the engineering profession. Covered in this report are deadlines demography, eligibility, project management, DOE support, publicity, application, various forms, and budget considerations. (FSD)

48835 (DOE/ER/75425–T1) **US Nuclear Engineering Education: Status and prospects.** National Research Council, Washington, DC (USA). Committee on Nuclear Engineering Education. [1990]. 157p. Sponsored by American Nuclear Society; U.S. DOE Energy Research; National Academy of Sciences/National Academy of Engineering/Institute of Medicine. DOE Contract AC01-88ER75425. Order Number DE90017286. Source: NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.

This study, conducted under the auspices of the Energy Engineering Board of the National Research Council, examines the status of and outlook for nuclear engineering education in the United States. The study, as described in this report resulted from a widely felt concern about the downward trends in student enrollments in nuclear engineering, in both graduate and undergraduate programs. Concerns have also been expressed about the declining number of US university nuclear engineering departments and programs, the ageing of their faculties, the appropriateness of their curricula and research funding for industry and government needs, the availability of scholarships and research funding, and the increasing ratio of foreign to US graduate students. A fundamental issue is whether the supply of nuclear engineering graduates will be adequate for the future. Although such issues are more general, pertaining to all areas of US science and engineering education, they are especially acute for nuclear engineering education. 30 refs., 24 figs., 49 tabs.

33 ADVANCED PROPULSION SYSTEMS

3301 Internal Combustion Engines

Refer also to citation(s) 48109, 48931

48836 (DOE/CE/90025–2) **Injector and valve train friction studies: Cummins L-10 engine: Progress report, October 1, 1988–December 31, 1989.** Mitchell, R.R.; Patterson, D.J. Michigan Univ., Ann Arbor, MI (USA). Dept. of Mechanical Engineering and Applied Mechanics. 15 Feb 1990. 78p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG02-88CE90025. Order Number DE90017288. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This report discusses measurement techniques developed and experimental results obtained for a valve and injector train friction study supported by the US Department of Energy. The incentives for this research are the higher injector train forces and potential friction problems associated with advanced technology diesel engines. As a convenient way to begin the program, the instrumentation was developed around the exhaust valve of cylinder number 1. Results are presented for that valve in a motored Cummins L-10 engine. The instantaneous cam/roller friction force was determined from the instantaneous roller speed and the pin friction torque. Measured as well were the pushrod force and displacement. Friction work loss was determined for both the cam and roller interface as well as the upper valve train. Future efforts will address the injector train and a fired engine with advanced technology components. 23 figs.

3302 External Combustion Engines

48837 (NEDO-P–8927) **Study on feasible applications of stirling cycle machine.** New Energy Development Organization, Tokyo (Japan). Mar 1990. 494p. (In Japanese). Order Number DE91701463. Source: NTIS (US Sales Only), PC A21/MF A01.

The feasibily study of a stirling cycle machine was made on its application to air conditioners and a refrigerating machines as well as on the utilization of various heat sources such as LNG cryogenic heat, solar energy, and that of incinerator waste heat. Its application to the air conditioners was technically verified already by the development research which has been made by New Energy and Industrial Technology Development Organization. Its application research on the field of the refrigerating machines is promoted, but it is considered that the machines will also play important role in promoting the latest leading techniques such as superconductivity. LNG cryogenic power generation is the new field which has been technically developed first in Japan in the world in which country a large quantity of LNG is consumed, and the high efficiency utilization of the stirling cycle machines in this field is expected to be realized in future. It is a important problem to establish the technical basis of a solar energy stirling cycle machine, and they are promoting to develop this machine for practical use not only in Japan but also in many countries in the world. Further, the technical development of the stirling cycle machines utilizing heat sources such as waste heat, geothermal heat, and woody fuel, is also laid on a important situation. 95 refs., 375 figs., 110 tabs.

3303 Electric-Powered Systems

Refer also to citation(s) 48845

48838 (CONF-9006243–3) **Shipping, use, and disposal/recycle considerations for sodium/beta batteries in electric vehicle (EV) applications.** Patil, P.G. (USDOE, Washington, DC (USA)); Henriksen, G.L.; Vissers, D.R.; Christianson, C.C. Argonne National Lab., IL (USA). [1990]. 24p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From 8. beta battery workshop; Chester (UK); 12-18 Jun 1990. Order Number DE90017667. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Shipping, in-vehicle use, and disposal/recycling considerations for sodium/beta batteries in electric vehicle (EV) applications were addressed in May 1990 at a US Department of Energy (DOE) planning meeting. DOE commissioned Argonne National Laboratory (ANL) to organize and conduct this meeting to help establish US and international regulations needed for the commercial introduction of sodium/beta battery powered EVs. Participation was limited to approximately 40 invited representatives from five countries – Canada, West Germany, Japan, UK and US. The participants were about equally divided between industry and the US government and national laboratories. In addition to numerous specific recommendations by working teams in each regulatory area, general recommendations included: DOE leadership in organizing an oversight committee and subcommittees which meet at regular intervals; continue participation by battery developers, automobile manufacturers, and US regulatory agencies; and invite participation by Canadian government, US Department of Defense, Electric Power Research Institute, and industrial waste disposal/reprocessing experts.

48839 (DOE/ID–10287) **A microprocessor based charge control system for the simultaneous charging of several batteries with one charge controller: Final report for 1989.** Nowak, D. (Alabama Univ., Huntsville, AL (USA). Kenneth E. Johnson Research Center). EG and G Idaho, Inc., Idaho Falls, ID (USA); Alabama Univ., Huntsville, AL (USA). Kenneth E. Johnson Research Center. 16 May 1990. 52p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. Order Number DE90017089. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The objective of this project as covered in this report, is the reduction of the cost of microprocessor controlled charging with complex algorithms, such as the UAH (University of Alabama in Huntsville) charge algorithm for sealed lead-acid batteries. The use of one charge controller for the simultaneous charging of several vehicles reduces the cost of hardware proportional to the number of vehicles that can be charged per controller. This cost savings is the order of several hundred dollars per vehicle (cost of the controller). However, more complex controller programming is required. Thus, there is a one-time investment in software development. 2 refs., 18 figs., 1 tab.

48840 (LBL–26455, pp. 198) **Electrode kinetics and electrocatalysis.** Ross, P.N. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Carbon blacks are important materials used in a variety of battery systems, and each system often makes use of a specific property of the carbon, e.g., conductivity, corrosion resistance, capacitance, catalytic activity, etc. In spite of their importance and wide use, the relation of their chemical properties to precursor and treatment history is not well understood, and considerable advancement in technologies using carbon materials appears possible. In the case of air electrodes in metal-air batteries, the carbon is used as a support for the active catalyst, i.e., to achieve and maintain high dispersion, and as a current collector, since the active catalyst may not have high bulk conductivity and may be relatively expensive and/or heavy. Thus, the unique properties of carbon of interest in this application are conductivity, surface area, and corrosion resistance. It is known that dramatic changes in structure and chemical properties occur when carbon blacks are heat-treated in an inert atmosphere at temperatures varying from 1,000 to 3,000°C. Heat-treatment conditions can be combined with selection of the carbon precursor to tailor the properties of the carbon black to suit the application. The particular technical challenge in air electrodes is to develop a carbon with sufficient corrosion resistance, conductivity, and surface area to meet the lifetime and performance requirements for electric-vehicle applications.

3305 Flywheel Propulsion

Refer also to citation(s) 48845

3306 Vehicle Design Factors

Refer also to citation(s) 48845

3307 Emission Control

48841 (LRU/C–23440M7M9133/01MSS) **The determination of the levels of dinitropyrenes on diesel exhaust particulate exhibiting excess mutagenic activity: Final report.** Westaway, K.C. Laurentian Univ., Sudbury, ON (Canada). Dept. of Chemistry. Jan 1989. 34p. Contract EMR 79133-01-SS. (MICROLOG–90-03381). Source: PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

High volume samples of diesel exhaust particulate have been collected downstream from two different Deutz 714 series diesel engines fitted with Dieseler III catalytic converters. The samples were collected on a level underground site with an 800 tramming distance to the ore pass. This should have ensured that the diesel particulate and the absorbed poly-aromatic hydrocarbons (PAHs) would have been stored and nitrated (converted into the highly mutagenic nitroPAHs) in the catalyst during the long tramming portion of the long haul dump cycle. In spite of this, only 1 out of 6 diesel exhaust extracts was mutagenic in the Ames bioassay, using Salmonella tester strain TA-98-S9. Even the one sample that contained mutagens was only slightly mutagenic, i.e., the exhaust was only as mutagenic as the exhaust from a bare engine. Thus, none of the samples contained significant quantities of the highly mutagenic nitroPAHs. However, the diesel exhaust extracts from the samples collected in this study differed from those found in other studies in two ways: these extracts were several times more toxic

to the Salmonella bacteria than any of the previous extracts; and these extracts contained a dimethyl suffoxide (DMSO)-insoluble material, whereas all the previous extracts dissolved completely in the DMSO used in the Ames bioassay. Neither the nature of the DMSO-insoluble material nor the source of the toxicity have been discovered. 12 refs., 2 figs., 6 tabs.

3308 Alternative Fuels

Refer also to citation(s) 49469

48842 (CRFA–90-01413) **Let's clear the air.** Canadian Renewable Fuels Association (Canada); Biomass Energy Inst., Inc., Winnipeg, MB (Canada). [1989]. vp. (CONF-8910455–: Let's clear the air, Toronto (Canada), 18 Oct 1989; MICROLOG–90-01413). Source: PC Biomass Energy Institute Inc., 1329 Niakwa Road East, Winnipeg, MB, CAN R2J 3T4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

These proceedings deal with the environmental impacts of fossil fuels; the advantages of alternative motor vehicle fuels (primarily oxygenated fuels) in reducing air pollution; a Canadian case study on ethanol production; and research conducted at Ford Motor Company into alternative fuels and flexible-fuel vehicles. Background information on alternative fuels and the pollution resulting from motor vehicle fuels is also provided. Separate abstracts have been prepared for 5 papers.

48843 (CRFA–90-01413, pp. 1-10, Paper 2) **Vehicle research for future fuels.** Nichols, R. (Ford Motor Co., Dearborn, MI (USA)). Canadian Renewable Fuels Association (Canada); Biomass Energy Inst., Inc., Winnipeg, MB (Canada). [1989]. (CONF-8910455–: Let's clear the air, Toronto (Canada), 18 Oct 1989; MICROLOG–90-01413). In *Let's clear the air.* Source: PC Biomass Energy Institute Inc., 1329 Niakwa Road East, Winnipeg, MB, CAN R2J 3T4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The paper discusses vehicle research at Ford Motor Company as applied to alternative vehicular fuels. Research was done on propane, compressed natural gas (liquid natural gas was the subject of less attention because it can only be handled by specialists), and alcohol fuels. Much engine design work for ethanol as been done by Ford Brazil; in the United States and Canada, Ford has concentrated on methanol vehicles. The current government interest in alternative fuels is based, in the short term, on their potential for improvement in air quality and, in the long term, on a concern for security of supply. Both dedicated and flexible-fuel vehicles have been built and tested at Ford. The trials of these tests are summarized, as are the design changes required by alcohol fuels. A new optical sensor for the fuel, calibrated from 0 to 100% alcohol, is presented, and its durability is discussed. Fuel formulation is also discussed. For safety, methanol should not be employed in a pure form because it does not form soot and therefore cannot be seen to be burning, and also because its vapor can catch fire at normal ambient temperatures. Cold start-up, engine durablity, and emissions compliance for aldehydes are discussed, both for methanol and ethanol fuels. It is explained why methanol fuels give a reduction in ozone emissions. General considerations on global warming are presented toward the end of the paper. 2 figs.

48844 (CRFA–90-01413, pp. 1-5, Paper 3) **The results and politics of oxygenated fuels in Colorado.** Massaro, T. (Denver Environmental Affairs, Denver, Co (USA)). Canadian Renewable Fuels Association (Canada); Biomass Energy Inst., Inc., Winnipeg, MB (Canada). [1989]. (CONF-8910455–: Let's clear the air, Toronto (Canada), 18 Oct 1989; MICROLOG–90-01413). In *Let's clear the air.* Source: PC Biomass Energy Institute Inc., 1329 Niakwa Road East, Winnipeg, MB, CAN R2J 3T4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper describes Colorado's oxygenated fuels program which ran from November 1, 1988 to March 1, 1989. This program was based on 3 principles: it was an air quality program, the consumer should have a free choice among oxygenated fuels; and the introduction, use, and expansion of oxygenated fuels should be implemented progressively. The implementation of the program is outlined and the relevant regulatory bodies listed. A low oxygen content was chosen, so as to allow both ethanol and MTBE (methyl tertiary butyl ether) to compete in the market-place. The viewpoints of oil companies, ethanol companies, car companies, the state legislature, the city of Colorado Springs, and the University of Denver, are presented. The results of the program are summarized. During its implementation, all gasoline sold along the Front Range of Colorado, from Fort Collins to Colorado Springs, had to contain a minimum of 2 wt % of oxygen. During that period, CO pollution in the metropolitan Denver area was reduced by 12%. Only 6% of the fuels sold was ethanol; the rest was MTBE. The cost to the consumer was between 0 and 2 cents/galion.

48845 (DOE/PE–0095P) **Assessment of costs and benefits of flexible and alternative fuel use in the US transportation sector: Technical report four: Vehicle and fuel distribution requirements.** USDOE Office of Policy, Planning and Analysis, Washington, DC (USA). Resource Management. Aug 1990. 54p. Sponsored by U.S. DOE Office of Policy, Planning and Analysis. Order Number DE90014847. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Alternatives to conventional motor gasoline and diesel fuel are being researched for energy security and environmental reasons. The three fuels with the most potential to displace a significant portion (e.g., 1 million barrels per day) of conventional fuels over the next 10 to 15 years are methanol (either neat or blended with gasoline), compressed natural gas (CNG), and electricity. Each has vehicle fuel characteristics very different from gasoline or diesel fuel that require changes to existing vehicle designs and fuel distribution systems. For example, although methanol is a liquid like gasoline, it requires nearly twice the storage space in terminals, delivery trucks, refueling stations, and vehicles. It is also more corrosive than gasoline, which can create materials compatibility problems in current highway vehicles and petroleum product distribution equipment. CNG (a gas, not a liquid) must be distributed by natural gas pipelines rather than petroleum pipelines or trucks. Service stations will need equipment to compress the gas sufficiently in vehicle storage cylinders to make it a useful vehicle fuel. Even compressed, CNG requires approximately 6 times the storage volume of gasoline on an energy equivalent basis. A substantial storage battery pack is required to use electricity as a vehicle fuel. For example, a 4-passenger electric vehicle (EV) with nickel-iron batteries may contain a battery pack weighing 1100 lb (499 kg). Further, EV's must be plugged in to an electric outlet to be "fueled." This report is a synthesis of these DOE-sponsored studies. It characterizes methanol, natural gas, and electric vehicles, discusses their costs and displacement potential, identified distribution system changes and costs for each fuel, and finally, compares and evaluates the three sets of infrastructure changes and costs. 26 refs., 14 figs., 35 tabs.

35 ARMS CONTROL

Refer also to citation(s) 49397

48846 (AD-A–222692/6/XAB) **Analysis of the morality of intention in nuclear deterrence, with special reference to final retaliation. Doctoral thesis.** Zink, J.A. Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). 1990. 228p. (AFIT/CI/CIA–90-14D). Source: NTIS, PC A11/MF A02.

Quite apart from its apparent political obsolescence, the policy of nuclear deterrence is vulnerable to attack for its seemingly obvious immorality. Nuclear war is blatantly immoral, and nuclear deterrence requires a genuine intention to resort to the nuclear retaliation which would precipitate such a war. Therefore, since it is wrong to intend that which is wrong to do, deterrence is immoral. This thesis seeks to examine the nature of the deterrent intention as a means of verifying the soundness of the above deontological argument. This examination is carried out by first suggesting an acceptable notion of intention in general and then, after analysing the views of

deterrent intention by other writers, proceeding to demonstrate the uniqueness of that intention. Having done this, and having explored the possibility that deterrence need not contain a genuine intention to retaliate, the thesis moves on to suggest and defend a moral principle which states that endeavours requiring the formation of an immoral intention may nevertheless be moral. Called the Principle of Double Intention (and based on the Principle of Double Effect), it offers a method for the moral assessment of agents who form immoral intentions within larger contexts. By applying this principle to nuclear deterrence, it is demonstrated that agents who undertake such a policy may be morally justified in doing so, provided certain conditions are met. The thesis closes with a refutation of the objection that an agent cannot rationally form an intention (such as that required in deterrence) which he has no reason to carry out.

3501 Policy, Negotiations, and Legislation

Refer also to citation(s) 48389, 48390, 48391

48847 (IAEA-INFCIRC–378) **Twentieth anniversary of the entry into force of the Treaty on the Non-Proliferation of Nuclear Weapons.** International Atomic Energy Agency, Vienna (Austria). Mar 1990. 2p. Order Number DE91602675. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The document reproduces the statement made by President Bush on March 5, 1990, on the 20th Anniversary of the entry into force of the Treaty on the Non-Proliferation of Nuclear Weapons.

48848 (IAEA-INFCIRC–382) **Texts of joint USA-USSR statements following the summit meeting in Washington, D.C., 31 May - 3 June 1990.** International Atomic Energy Agency, Vienna (Austria). Jul 1990. 8p. Order Number DE91602677. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Hard copies are available in English and Russian from IAEA Division of Publications, Distribution Unit.

The texts of joint USA-USSR statements following the summit meeting in Washington, D.C., 31 May - 3 June 1990 are reproduced. One is a joint statement on non-proliferation of nuclear weapons, missile and missile technology and chemical weapons, another one is a joint statement on the International Thermonuclear Experimental Reactor and the last one is a joint statement on Cooperation in Peaceful Uses of Atomic Energy.

3502 Proliferation

48849 (AD-A–223215/5/XAB) **Chemical weapons proliferation in the Middle East: What is the proper response. Study project.** DeShazer, M. Army War Coll., Carlisle Barracks, PA (USA). 9 Apr 1990. 33p. Source: NTIS, PC A03/MF A01.

The use of chemical weapons in the Middle East, Southeast Asia and Africa in recent regional and ethnic conflicts illustrates the proliferation of chemical weapons and use in the Third World. The use of these weapons has been indiscriminate and intentionally directed at noncombatants and combatants. This paper will focus on chemical weapons proliferation in the Middle East. This paper assesses the motivations behind the proliferation and provides a perspective on the nature of the threat, as well as the role Western industry plays in facilitating the development and proliferation. The study points out that Middle East countries have greatly expanded their chemical capability and that they have every intention of using it. Moreover, foreign suppliers are providing assistance to these countries as negotiations are underway to decrease worldwide chemical armaments through a Chemical Weapons Treaty. Finally, the study suggests that the proper response ought to be a strategy with a multi-dimensional approach aimed at the political and economic sources of passion that drive nations in the Middle East to acquire chemical weapons.

3503 Verification

48850 (AD-A–222911/0/XAB) **Intelligence support to arms control. Study project.** Grisham, A.E. Army War Coll., Carlisle Barracks, PA (USA). 9 Apr 1990. 46p. Source: NTIS, PC A03/MF A01.

This paper argues that intelligence support is critical to the success of arms control. It identifies and describes the roles of intelligence in the arms control process, describes the existing intelligence organizational structure for arms control support, and identifies and analyzes issues. The roles include support to policy formulation, support to treaty negotiation, support to ratification, and finally, during verification, support for the implementation of the treaty through monitoring. The Director of Central Intelligence is responsible for monitoring, while the Arms Control and Disarmament Agency has responsibility for verification. Adjudication of conflicting interpretations occurs within the NSC committee structure. For several reasons, intelligence cannot be expected to do the actual verification of an arms control treaty. Most importantly, determination of an acceptable degree of confidence is always a political issue, although based on military judgement. Assigning intelligence responsibility for monitoring, rather than verification, helps to limit the politicization of intelligence. Issues identified during the research for this paper were analyzed within three subgroups: those inherent in the intelligence discipline; these must be managed successfully to limit adverse impact on intelligence products. Second, issues and challenges inherent in arms control bureaucratic relationships; these are best managed by keeping separate the actual monitoring analysis and verification this gives the West justification for caution, and reinforces the need for continued emphasis on verification.

48851 (UCRL-JC–104359) **Risk of disclosure of sensitive information during warhead dismantlement.** Strait, R.S. Lawrence Livermore National Lab., CA (USA). 15 Jul 1990. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9007106–61: Institute of nuclear materials management conference, Los Angeles, CA (USA), 15-18 Jul 1990). Order Number DE90016470. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Future arms control treaties may provide for dismantlement of warheads and/or controls on nuclear material. Choosing procedures and technologies for verifying compliance with such provisions requires trading-off the relative benefits and costs of the alternatives. One of the most important costs is the risk of disclosure of sensitive national security information. We present a risk analysis approach that has been developed to assess the relative risks of different verification measures, including many that are routinely used in nuclear materials safeguards. The five step methodology incorporates the relative probabilities of disclosure, the quality of the information in the disclosures, and the relative impacts of the disclosures for national security. These components of risk are then combined in a relative risk index, which can be used to choose among competing alternatives. We explain the methodology and highlight key assumptions. Key issues in implementing the approach are discussed, as are the most important factors in structuring the analysis and in assessing the relevant parameters.

36 MATERIALS

Refer also to citation(s) 49075, 49097, 49130, 50086

48852 (N–90-23773) **Stress versus temperature dependent activation energies in creep.** Freed, A.D.; Raj, S.V.; Walker, K.P. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1990. 12p. (NASA-TM–103192;E–5580;NAS–1.15:103192;CONF-910120–: 3. international conference on constitutive laws for engineering materials: theory and application, Tucson, AZ (USA), 7-12 Jan 1991). Source: NTIS, PC A03/MF A01.

The activation energy for creep at low stresses and elevated temperatures is lattice diffusion, where the rate controlling mechanism for deformation is dislocation climb. At higher stresses and intermediate temperatures, the rate controlling mechanism changes from that of dislocation climb to one of obstacle-controlled dislocation glide. Along with this change, there occurs a change in the activation energy. It is shown that a temperature-dependent Gibbs free energy does a good job of correlating steady-state creep data, while a stress-dependent Gibbs free energy does a less desirable

job of correlating the same data. Applications are made to copper and a LiF-22 mol. percent CaF2 hypereutectic salt.

48853 (N-90-24350) **National Educators' workshop: Update 1989 standard experiments in engineering materials science and technology.** Gardner, J.E.; Jacobs, J.A. National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center. May 1990. 182p. (NASA-CP-3074;L-16785;NAS-1.55:3074;CONF-8910299-: National Educators workshop, Norfolk, VA (USA), 17-19 Oct 1989). Source: NTIS, PC A09/MF A02.

Presented here is a collection of experiments presented and demonstrated at the National Educators' workshop: Update 89, held October 17 to 19, 1989 at the National Aeronautics and Space Administration, Hampton, Virginia. The experiments related to the nature and properties of engineering materials and provided information to assist in teaching about materials in the education community.

3601 Metals and Alloys

Refer also to citation(s) 48105, 48117, 48118, 48119, 48120, 48217, 48218, 48240, 48278, 48288, 48294, 48383, 48494, 48526, 48529, 48530, 48535, 48537, 48538, 48571, 48578, 48608, 48646, 48676, 48684, 48692, 48693, 48695, 48757, 48836, 48912, 48930, 48943, 48979, 48985, 48988, 49004, 49038, 49046, 49051, 49053, 49055, 49076, 49078, 49080, 49098, 49099, 49100, 49107, 49109, 49111, 49112, 49114, 49115, 49117, 49119, 49120, 49125, 49165, 49195, 49205, 49217, 49218, 49738, 49878, 49880, 49881, 50075, 50076, 50167, 50172, 50173, 50234, 50239

48854 (AD-A-222891/4/XAB) **Metallurgical processes in multi-component rare earth-transition metal permanent magnet alloys. Final report, 15 May 1987-14 May 1990.** Ray, A.E. Dayton Univ., OH (USA). Research Inst. 30 May 1990. 8p. Contract DAAL03-87-K-0082. (UDR-TR-90-57). Source: NTIS, PC A02/MF A01.

The primary objective of this research has been to improve and extend the technology of 2:17 type permanent magnets. The research has proceeded by employing a model for the complex metallurgical behavior of these alloys. During the three year period of this research, we have succeeded in establishing a record value (BH)max=34 MGOe for energy product in uncompensated Sm(CouFevCuxZry)z magnets. This was achieved by increasing the Fe content to v=0.31-0.33 (28-30 at.%) while developing heat treatments to maintain the coercivity at high levels. Keywords: Permanent magnets; Rare earth-transition metal permanent magnets; R2:TM17 type rare earth magnets; Sm(Gd),Co,Fe,Cu,Zr alloys, Model for metallurgical behavior.

48855 (AD-A-222951/6/XAB) **Corrosion protection of metal-matrix composites. Final report, October 1986-April 1990.** Mansfeld, F.; Lin, S.; Shih, H. University of Southern California, Los Angeles, CA (USA). 1 Apr 1990. 114p. Contract DAAL03-86-K-0156. Source: NTIS, PC A06/MF A01.

Corrosion protection of Al alloys, Al-based metal matrix composites (MMCs), and Al-Li alloy by conversion coatings, anodized layers, polymer coatings, and chemical passivation in $CeCl_3$ has been evaluated in a simulated marine environment (0.5 N NaCl) by electrochemical impedance spectroscopy (EIS). Conversion coatings, anodizing, polymer coatings have been evaluated for MgAZ31B. Chromate conversion coatings (Alodine 600) provided corrosion protection for Al/SiC and Al/Gr MMCs, but were not as effective as for Al 6061. For Al/SiC it was observed that sulfuric acid anodizing did not produce the corrosion resistance obtained for the Al 6061. The corrosion resistance for hard anodized Al/SiC was less than that for conventional anodized Al/SiC.

48856 (AD-A-222960/7/XAB) **Study of constitution diagram aluminum-tantalum.** Glazov, V.M.; Mal'tsev, M.V.; Chistyakov, Y.D. Foreign Technology Div., Wright-Patterson AFB, OH (USA). 20 Oct 1988. 22p. (FTD-ID(RS)T-0923-88). Source: NTIS, PC A03/MF A01.

Partially edited machine trans. of Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk (USSR), No. 4, 131-136(Apr 1956).

Alloys of aluminum with tantalum were for the first time obtained by aluminothermic method in 1868 by Moriniak. Later these alloys were studied in the works of Schirmeister (1915) and Brouwer (1938), moreover Brouwer established that tantalum with aluminum forms the chemical compound TaA1, which has tetragonal crystal lattice with parameters a=5.422 angstroms and c=8.536 angstroms (1). However despite the fact that alloys of aluminum with tantalum long ago are obtained already, constitution diagram of this system is not studied until recently. In connection with the application of tantalum as the modifying additive in aluminum alloys an emergency in the construction of this diagram, without the knowledge by which it is not possible to give the correct explanation of the mechanism of the very process of the modification of primary grain. For this purpose was undertaken this work. Russian translations.

48857 (BNL-43758) **Determination of hydrogen (deuterium) density profiles in thin metal films and multilayers by neutron reflection.** Majkrzak, C.F. (National Inst. of Standards and Technology, Gaithersburg, MD (USA)); Satija, S.; Neumann, D.A.; Rush, J.J.; Lashmore, D.; Johnson, C.; Bradshaw, J.; Passell, L.; DiNardo, R. Brookhaven National Lab., Upton, NY (USA). [1990]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-901105-1: Fall meeting of the Materials Research Society, Boston, MA (USA), 26 Nov - 1 dec 1990). Order Number DE90007150. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The density of hydrogen in thin films or multilayers of metal hydrides can be inferred from an expansion of the host lattice as measured by conventional x-ray diffraction techniques. However, because hydrogen and deuterium have scattering lengths for neutrons that are comparable to those of most metal nuclei, unlike the corresponding case for x-ray atomic scattering amplitudes, the hydrogen density profile normal to the surface of a flat, thin film can be determined directly from neutron reflectivity measurements. The hydrogen (deuterium) density modulation in an artificial superlattice along the growth direction can also be determined in this manner. The thin film or multilayer host metal material need not even be crystalline. Furthermore, because relatively large, flat single crystal substrates such as Si or quartz are nearly transparent to neutrons, the substrate can serve as the incident medium and the reflectivities of films or multilayers in contact with liquid solutions can be obtained. Thus, in situ studies employing active electrochemical cells, for example, can be performed. In addition to discussing the sensitivity of the method, the results of some neutron reflectivity experiments on metal multilayers and films, electrolytically loaded in situ with deuterium, are reported in this paper. 9 refs., 4 figs., 1 tab.

48858 (BWC-90-03956) **Weld process development for fabrication of heavy wall pressure vessel: Part 3.** Wright, B. Babcock and Wilcox Canada Ltd., Toronto, ON (Canada). [1990]. 63p. Contract EMR OSQ85-00090. (MICROLOG-90-03956). Source: PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Pressure vessels for processing fuel from conventional and tar sands resources involves fabrication of heavy wall thickness 2.25Cr-1Mo material. Canadian fabricators are restricted by the availability of forged shell sections to produce these vessels, so that the use of formed plate to manufacture shell sections requires evaluation. Narrow gap welding processes have been developed to weld heavy wall thicknesses effectively. In this study comparing fabrication techniques for the manufacturer of a shell section, a 1.83 m inside diameter pressure vessel section has been fabricated from 203 mm thick 2.25Cr-1Mo using the Esab HNG Narrow Gap Welding System to weld the circumferential seam. Procedures used for the longitudinal and circumferential seams provided welds that were acceptable to standards established for nondestructive examination. Comparisons are made between the fabrication of 2.25Cr-1Mo and C-Mn steel pressure vessel sections. The Charpy V-Notch toughness distribution within the Narrow Gap welded circumferential seam has been evaluated and the area of lowest

toughness has been shown to meet the aimed value of 54 J absorbed energy at -40°C. 12 refs., 23 figs., 13 tabs.

48859 (CEA-CONF-9407) **Compatibility of 316L stainless steel with the liquid alloy Pb17Li.** Broc, M.; Fauvet, P.; Flament, T.; Terlain, A.; Sannier, J. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Chimie Appliquee et d'Etudes Analytiques. 1988. 10p. (CONF-881009–: LIMET'88: 4. international conference on liquid metal engineering and technology, Avignon (France), 17-21 Oct 1988). Order Number DE91700548. Source: NTIS (US Sales Only), PC A02/MF A01.

The behavior of 316L austenitic stainless steel in liquid eutectic lead alloy is investigated. The 316L is a possible structural material for fusion reactors. The obtained results are summarized and compared with other experimental data. The mechanisms which control the corrosion process are discussed. The investigation shows that whatever, the hydraulic flow, the corrosion of 316L stainless steel exposed to Pb17Li is characterized by the formation of a porous ferritic layer. The corrosion kinetics is mainly dependent on temperature, hydraulic flow and metallurgical state of the steel. At 400°C in turbulent flow, the corrosion rate at steady state of 316L solution annealed is estimated to 27 microns/year to which a depth of 25 microns has to be added to take into account the initial transient period. From overall available results, dissolution and solid state transformation in case of turbulent flow and diffusion in liquid phase for laminar flow, may be suggested.

48860 (CONF-900466–85) **Molecular-dynamics study of grain-boundary migration in metals.** Rickman, J.M.; Phillpot, S.R.; Wolf, D. Argonne National Lab., IL (USA). May 1990. 9p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Contract N00014-88-F0019. From Spring meeting of the Materials Research Society; San Francisco, CA (USA); 16-21 Apr 1990. Order Number DE90017856. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The migration of a (100) $\Theta = 43.6°$ ($\Sigma 29$) twist grain boundary is observed during the course of a molecular-dynamics (MD) simulation. The migration is investigated by calculating changes in the planar structure factor $S_p(k)$, the orientation of interparticle bonds in the migrating plane, and the motion of the center of mass planes near the grain boundary. It is found that (a) migration is accompanied by sliding, and (b) each migration step consists of a series of local bond rearrangements. It appears that, as a precursor to migration, Frenkel-like defects are produced at the grain boundary. 6 refs., 5 figs.

48861 (CONF-900577–2) **Magnetic properties of ultrathin epitaxial films of iron.** Liu, C.; Bader, S.D. Argonne National Lab., IL (USA). [1990]. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Symposium on surface processing and laser assisted chemistry in conjunction with the spring meeting of the European Materials Research Society; Strasbourg (France); 29 May - 1 jun 1990. Order Number DE90017861. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Ultrathin Fe films epitaxially grown on Cu(100), Au(100), Pd(100), and Ru(0001) substrates are used to study monolayers magnetism, surface magnetic anisotropy and two-dimensional (2D) critical behavior, by means of in-situ surface magneto-optical Kerr-effect measurements. Epitaxial structures and growth modes are characterized by auxiliary low-energy electron diffraction and Auger electron studies. The magnetic properties of the films depend on the growth temperature. For 100-K growth, all films exhibit a universal behavior of perpendicular spin orientations in the monolayer regime, while for 300-K growth, Fe/Pd(100) and Fe/Au(100) have in-plane easy-axis of magnetization for all thicknesses. Fe/Ru(0001) lacks a ferromagnetic response for thickness less than two monolayers (ML). Fe/Pd(100) has remarkable thermal stability in the monolayer and submonolayer range. Reversible magnetization data are obtained for 0.6 to 3.0-ML-thick films, which show second-order phase transitions at thickness-dependent Curie temperatures (T_c). An effective magnetization exponent β_{eff} of 0.127 ± 0.004 is obtained for a 1.2-ML Fe/Pd(100) film, agreement with the theoretical value of $\beta_c = 0.125$ for an ideal 2D Ising model. The T_c trend with film thickness for Fe/Pd(100) is also in agreement with Monte-Carlo calculations for Ising films.

48862 (CONF-900623–18) **The interaction of point defects with line dislocations in HVEM [high voltage electron microscope] irradiated Fe-Ni-Cr alloys.** King, S.L. (Oxford Univ. (UK). Dept. of Materials); Jenkins, M.L.; Kirk, M.A.; English, C.A. Argonne National Lab., IL (USA). May 1990. 25p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 15. symposium on effects of radiation on materials; Nashville, TN (USA); 17-21 Jun 1990. Order Number DE90017691. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper presents results of a study of the interaction of point defects produced by high voltage electron microscope (HVEM) irradiation with pre-existing dislocations in austenitic Fe-15% & 25%Ni-17%Cr alloys, aimed at the determination of the mechanisms of climb of dissociated dislocations. Dislocations were initially characterized at sub-threshold voltages (here 200kV) using the weak-beam technique. These dislocations were then irradiated with 1MeV electrons in the Argonne HVEM before being returned to a lower voltage microscope for post-irradiation characterization. Interstitial climb was seen only at particularly favorable sites, such as pre-existing jogs, whilst vacancies clustered near dislocations, forming stacking fault tetrahedra (SFT). Partial separations were also observed to have decreased after irradiation. The post-irradiation configuration was found to depend strongly on both dislocation character and pre-irradiation dislocation configuration. These results, and their relevance to the void swelling problem, are discussed. 52 refs., 8 figs.

48863 (CONF-900936–3) **The effect of defect clusters formed in cascades on the sink strength in irradiated materials.** Wiedersich, H. Argonne National Lab., IL (USA). Sep 1990. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 7. international conference on ion beam modification of materials; Knoxville, TN (USA); 9-14 Sep 1990. Order Number DE90017815. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Defects produced by irradiation with energetic particles are most often spatially strongly correlated. Energetic primary recoil atoms produce generally more or less dense cascades in which vacant lattice sites predominate in the central regions, and interstitial atoms are deposited at the periphery. In fact, in many cases a fraction of the defects produced in the cascades form clusters during the cascade event. In this paper we examine the role of these clusters as defect sinks during high dose irradiations at moderate temperatures. It is shown that a steady state population of vacancy and interstitial clusters evolves during irradiation which significantly contributes to the overall sink density in the material. At sufficiently low temperature, i.e., at which thermal evaporation from vacancy clusters can be neglected, the steady state cluster density is characteristic of the primary recoil spectrum, but does not depend on temperature or dose rate. Consequently, contributions by migrating defects to irradiation-enhanced diffusion or to ion-beam mixing should also be temperature and dose-rate independent. When thermal evaporation of vacancies from small defect clusters becomes competitive with absorption of excess interstitials, the cluster population becomes temperature and rate dependent.

48864 (CONF-900936–6) **The stability of irradiation-induced defects in NiAl.** Caro, J.A. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)); Pedraza, D.F. Oak Ridge National Lab., TN (USA). [1990]. 12p. Sponsored by U.S. DOE Energy Research; Fonds National Suisse de la Recherche Scientifique; National Energie-Forschung-Fonds. DOE Contract AC05-84OR21400. From 7. international conference on ion beam modification of materials; Knoxville, TN (USA); 9-14 Sep 1990. Order Number DE90017744. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Vacancies, interstitials and antisite defects are produced in intermetallic compounds by irradiation with energetic particles. The manner in which these defects evolve during irradiation may contribute to microstructural changes such as the generation of dislocations, dislocation loops, voids, phase transformations and amorphization. In this work, the embedded-atom potentials for nickel and aluminum developed by Foiles, Baskes and Daw were used to calculate the energy of formation of antisite defects, of vacancies, and of various possible interstitial configurations in the B2

NiAl compound. The crowdion in the <111> direction that incorporates an extra nickel atom is found to be the lowest energy interstitial configuration. Using the same potentials, the distance for spontaneous recombination of Frenkel pairs is found to be third-nearest neighbor provided the chemical order is maintained. However, if the chemical order of the sites nearest to the interstitial is altered at a bcc cell adjacent to the cell occupied by the vacancy at the cell center, recombination is inhibited in several cases in which the Frenkel pair is found to be stable. The implications of these results for irradiation-induced amorphization are discussed. 20 refs., 2 tabs., 1 fig.

48865 (CONF-900975–1) **Chemical identification of icosahedral structure for cobalt and nickel clusters.** Winter, B.J.; Klots, T.D.; Parks, E.K.; Riley, S.J. Argonne National Lab., IL (USA). [1990]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 5. international symposium on small particles and inorganic clusters; Konstanz (Germany, F.R.); 10-14 Sep 1990. Order Number DE90017688. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Reactions of bare and hydrogenated cobalt and nickel clusters with ammonia and with water are used to determine cluster geometrical structure. Saturation measurements determine the total number of ammonia binding sites on cluster surfaces. A pattern of minima in the number of such sites is found to correlate with the sequence of closed shells and subshells expected for icosahedral packing in the 50- to 120-atom size range (50- to 200-atom range for hydrogenated clusters). In many cases there are 12 sites at the minima, the number that would be expected for preferred ammonia binding sites on closed (sub)shells of icosahedral clusters. The equilibrium adsorption of a single water molecule provides a sensitive measure of changes in cluster-water binding energy. A pattern of binding energy maxima is found, once again correlating with icosahedral structure, but for clusters having one metal atom more than the closed (sub)shells. In general, hydrogenation enhances the patterns of minima and maxima. These observations are explained in terms of the expected nature of ammonia and water binding to icosahedral clusters. 8 refs., 2 figs.

48866 (CONF-901073–7) **Laser Raman spectroscopy "for in-situ" analysis of corrosion films on metals.** Melendres, C.A. Argonne National Lab., IL (USA). Aug 1990. 34p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 178. meeting of the Electrochemical Society; Seattle, WA (USA); 14-19 Oct 1990. Order Number DE90017822. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The principles of laser Raman spectroscopy (LRS) are discussed, with particular reference to its applications to the study of corrosion and passivation phenomena in metals in aqueous solution environments. Results of studies on corrosion inhibition by organic compounds and passivity breakdown on iron are presented. The advantages and limitation of the LRS technique are pointed out. New directions toward corrosion studies in high temperature high pressure systems as well as the development of a technique for near monolayer detection sensitivity are discussed. 68 refs., 22 figs.

48867 (CONF-901105–3) **Mechanical properties, fracture behavior, and grain-boundary chemistry of B-doped NiAl.** George, E.P. (Oak Ridge National Lab., TN (USA)); Liu, C.T.; Liao, J.J. Oak Ridge National Lab., TN (USA). [1990]. 6p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From Fall meeting of the Materials Research Society; Boston, MA (USA); 26 Nov - 1 dec 1990. Order Number DE90015153. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper summarizes the results of our work aimed at overcoming the intrinsic grain-boundary weakness of NiAl by microalloying with boron. In previous work we have shown that 300 wppm boron is very effective in suppressing intergranular fracture in NiAl. It does this by segregating strongly to the grain boundaries and strengthening them. Despite this dramatic effect on the fracture mode, however, boron is unable to improve ductility because it is a potent solid solution strengthener, more than doubling the yield strength relative to that of undoped NiAl. The present work attempts to decrease this deleterious hardening effect by lowering the bulk concentration of boron in NiAl. Our results show that if the boron concentration in the bulk is lowered to 30 wppm, the yield strength of boron-doped NiAl is only about 30% higher than that if undoped NiAl. In addition, there is enough boron at the grain boundaries of this alloy to suppress intergranular fracture. Under these conditions, boron-doped NiAl has a tensile ductility of 2%, which is essentially identical to that of undoped NiAl. This result, namely that the strengthening of grain boundaries might well be the weakest links in NiAl, cleavage planes are not much stronger. In other words, even though boron additions serve to strengthen the grain boundaries and suppress intergranular fracture, ductility is note improved, because the next brittle fracture mode, namely transgranular cleavage, takes over before significant plastic deformation can occur. 18 refs., 2 figs., 2 tabs.

48868 (CONF-9005270–1) **Liquid alloys with strong interactions.** Saboungi, M.L.; Price, D.L.; Johnson, G.K.; Reijers, H.T.J. Argonne National Lab., IL (USA). [1990]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Thermodynamics of alloys conference; Barccelona (Spain); 23-26 May 1990. Order Number DE90017661. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Liquid alkali metals alloyed with either Pb or Sn show remarkable features in the electronic, thermodynamic, and structural properties at the "octet" composition and/or the equiatomic composition. A review of these properties will be presented, with special emphasis on the complementarity of information obtained from different experimental results. Recent molecular dynamics simulations of the structure and dynamics of the equiatomic alloys reveal interesting insights into the atomic structure and explain results obtained from inelastic neutron scattering. 33 refs., 8 figs.

48869 (DOE/ER/45328–4) **Surface phases and their influence on metal-oxide interfaces: [Progress report].** Blakely, J. Cornell Univ., Ithaca, NY (USA). 1990. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER45328. Order Number DE90017608. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The work described is a continuation of a project initiated in 1987 and supported by the Materials Sciences Division of the DOE. The first 2.5 years of the project have been devoted to building up facilities and some interesting preliminary results have been obtained. Two senior students are now working on this project and are well poised to do productive research over the next 3-year grant period. During the initial period of this work we have set up a scanning tunneling microscope, have modified and rebuilt a uhv system equipped with LEED, electron spectroscopy, and a sulfur beam source. We have also constructed a small 'portable' vacuum system for synchrotron x-ray diffraction studies of surface structure. Some preliminary results have been obtained on the projects detailed in the original proposal. We have continued to study the effects of submonolayers of adsorbed S on the growth and stability of oxide layers. These studies are of central interest to the field of oxide adhesion and high temperature stability of protective oxide scales. Although our work is of a rather fundamental nature it is nevertheless closely connected to real high temperature corrosion situations. The breakdown of adhesion between oxide and metal substrate due to the presence of impurities such as S, ultimately depends on the nature and strength of the bonds between O-Metal, W-Metal and in clusters of these elements.

48870 (EGG-M–90064) **Residual stress at fluid interfaces.** Murray, P.E. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1990]. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-901109–7: International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers, Dallas, TX (USA), 25-30 Nov 1990). Order Number DE90012964. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We extend the Navier-Stokes equations to allow for residual stress in Newtonian fluids. A fluid, which undergoes a constrained volume change, will have residual stress. Corresponding to every constrained volume change is an eigenstrain. We present a method to include in the equations of fluid motion the eigenstrain that is a result of the presence in a fluid of a soluble chemical species. This method is used to calculate the residual stress associated with a chemical transformation. 9 refs., 1 fig.

48871 (EUR–12388) **Extrapolation of stress rupture data on 9 to 12% Cr steels.** Wood, D.S. (Northen Research Labs. (UK)); Williamson, K.; Escaravage, C.; Ohly, W. Commission of the European Communities, Luxembourg (Luxembourg). 1989. 113p. Contract No RA1-0106-UK. Source: NTIS (US Sales Only), PC A06/MF A01.

In this document the stress rupture strengths at times of up to 300 000h have been evaluated. In relation to the stress rupture strength, data from four steels, namely 9Cr1Mo, 9Cr2MoNbV, 9Cr1MoVNb and 12CrMoV, were examined and in each case four different parameters (Larson-Miller, Orr-Sherby-Dorn (original), Orr-Sherby-Dorn (ORNL) and Manson-Haferd) were employed to extrapolate the data out to 300 000h. At temperatures relevant to steam generators (c. 500^{O}C) there was found to be little difference in predicted long-term strength values using the four approaches. However, the lower 95% confidence limits have been evaluated and it was found that for some of the steels these were different to the often assumed minimum set at 80% of the average. The rupture ductility values have been statistically evaluated at specific temperatures to establish the trend in ductility with increasing rupture time.

48872 (EUR–12402) **Thermophysical and thermochemical properties of fast reactor materials.** Harding, J.H. (UKAEA Harwell Lab., (UK)); Martin, D.G; Potter, P.E. Commission of the European Communities, Luxembourg (Luxembourg). 1989. 107p. Contract No ECI-1243-B 7221-84-UK. Source: NTIS (US Sales Only), PC A06/MF A01.

The physical and chemical properties of materials occurring within the core of a liquid sodium cooled fast breeder reactor (LMFBR) are reviewed. Properties particularly relevant to predicting the reactor's behaviour under various accident scenarios and during normal operations are considered and recommendations in a form suitable for use in computer codes which model such situations are put forward. Included in the review are the following properties: (a) Oxide fuels: density and thermal expansion, temperature of fusion, enthalpy and specific heat, vapour pressure, viscosity, diffusion and creep, emissivity, thermal conductivity, surface tension and energy. (b) AISI M316 stainless steel: composition, thermal expansion, temperature of fusion, enthalpy and specific heat, thermal conductivity, vapour pressure, viscosity. (c) Sodium: density, enthalpy and specific heat, vapour pressure, emissivity, diffusion, thermal conductivity, surface tension, viscosity, equation of state, critical constants.

48873 (FRCEA-TH–289) **Study of radiation effects on zircaloy 4 microstructure (Impact on susceptibility to fuel pellet-cladding interaction in PWR).** Lefebvre, F. CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Metallurgie; Institut National des Sciences Appliquees (INSA), 69 - Villeurbanne (France). Jan 1989. 150p. (In French). Order Number DE91702102. Source: NTIS (US Sales Only), PC A07/MF A01.

In PWR the fast neutron flux is an important parameter for fuel can aging by modification of zircaloy-4 microstructure: amorphisation and dissolution of intermetallic precipitates. These phenomena are both analysed and their influence on fuel-cladding interaction is discussed. Irradiations by 1 MeV electrons, Ar ions, Kr ions and fast neutrons are realized for comparison of damages with different defect creation kinetics. Amorphisation is explained as the crystal amorphous state transformation allowing precipitate dissolution by creation of a chemical potential gradient between matrix and amorphous phase. Progressive dissolution of precipitates produced by irradiation decrease the number of potential sites for stress corrosion cracking, improving rupture resistance of the alloy by fuel-cladding interaction.

48874 (IKE–5-230) **Investigations of defined oxides for improving the determination of emissivity of high temperatures. Pt. 1 and 2. Pt. 1: Determination of emissivity and optical constants. - Pt. 2: Preparation and analysis of probes.** Pflugfelder, G. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme); Guentert, F.; Neuer, G.; Grabke, H.J.; Schmidt, H.P. Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme. Jan 1990. 120p. (In German). Order Number DE90519897. Source: NTIS (US Sales Only), PC A06/MF A01.

A new measurement technique is described for the measurement of the optical constants of metals and oxide layers at high temperatures. The index of refraction and the extinction coefficient are calculated from the spectral emittance, measured at two different angles. Polished steel samples (Fe, Fe-20Cr-0.1Ce, and Fe-6Al-0,5Ti) and samples with specially prepared oxides (FeO, Fe_3O_4, Cr_2O_3, $FeCr_2O_4/Cr_2O_3$ and Al_2O_3) have been investigated. The thicknesses of the carefully analyzed layers varied between 200 A and 1000 A. The total and spectral emittance at wavelengths 1.2 μm to 8μm have been measured at temperatures between 850deg C to 1000deg C. The measurement uncertainties are discussed and experimental improvements are proposed. One of the problems to be solved at future measurements is the stability of the oxide at high temperature under a given experimental atmosphere. The oxides mentioned above partly disapeared partly continued growing during the measurments. The found optical constants were used to calculate the emittance as a function of the oxide layer thickness. The results are in quite good agreement with the measurement emittance values. This confirms that the spectral emittance of oxidized metals can be calculated by means of the optical constants if the composition and the layer thicknes is known. (orig./MM).

48875 (IPEN-PUB–129) **Determination of the stacking fault energies of face centured cubic metals and alloys by X-rays diffraction.** Borges, J.F.A.; Padilha, A.F.; Imakuma, K. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Mar 1988. 12p. (In Portuguese). Order Number DE91601550. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

An X-rays diffraction method was applied to measure the Stacking Fault Energies (SFE) of the AISI 304, AISI 316, AISI 347 and DIN-WERKSTOFF 1.4970 Austenitic Stainless Steels. The SFE determination plays an important role in the research of the mecanichal behaviour of the Metal and Alloys, their deformation mechanisms, stability of micro-structure and electronic configuration. The method is based on the relationship between the SFE and the ratio of the Mean Square Strains to the Stacking-Fault probability. The Mean Square Strain was evaluated by Fourier Analysis of X-rays Diffaction profiles, corrected to reduce instrumental effects, followed by the application of the Warren-Averbach method to the Fourier Coefficients. The Stacking-Fault probabilities were derived from the changes of peak separations between cold-worked and annealed specimens. (author).

48876 (IS–4992) **Production techniques for discontinuous filament A-15 superconductor wire.** Verhoeven, J.D. (Ames Lab., IA (USA)); Finnemore, D.K. Ames Lab., IA (USA). Apr 1989. 58p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE90017331. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Around 1977 several groups began to develop a new class of high performance multifilamentary superconducting composites for large scale magnets, in which the individual filaments are not continuous. The special feature of these composites is the long but discontinuous ribbon shaped filaments of Nb_3Sn or V_3Ga which are dispersed in a bronze matrix. Despite these discontinuities, critical current density is as good or better than bronze processed wire at magnetic fields up to around 12 T; the strain tolerance is higher; the ultimate tensile strength is better than the bronze wire by roughly a factor of 2. For applications where strength and strain tolerance are critical, these materials are superior; for applications where ac loss within the superconductor must be kept low or where fields above 12 T are necessary with Nb_3Sn, they are less satisfactory. In the present review, we will try to avoid duplication of details and make reference to the previous reviews where appropriate. In addition, we will present more detailed information with respect to our own work and will present information published or completed subsequent to the previous reviews. Also, the reference list presents a fairly complete listing through early spring 1983 giving the paper titles as an aid to indicate content. Throughout most of this review we will refer the processing steps to Nb_3Sn-Cu, but it should be realized that essentially identical steps apply to V_3Ga-Cu materials.

48877 (IS-M–623) **Deducing mechanical properties due to interfaces from their acoustical response.** Buck, O.; Thompson, R.B.; Rehbein, D.K.; Brasche, L.J.H.; Palmer, D.D. Ames Lab., IA (USA). [1989]. 10p. Sponsored by U.S. DOE Energy Research.

DOE Contract W-7405-ENG-82. (CONF-890310–7: 7. international conference on fracture (ICF-7), Houston, TX (USA), 20-24 Mar 1989). Order Number DE90016704. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The ultrasonic interrogation of a partially contacting interface provides details on the contact topology. In this paper this information is used to deduce important mechanical properties of structures containing fatigue cracks and diffusion bonds as specific examples of such interfaces. The information is sufficient to determine the residual stress distribution in the wake of the crack. These residual stresses produce a stress intensity factor which, in part, shields the crack from the externally applied stress intensity range and thus affects the fatigue crack propagation rate. For diffusion bonds in materials of low ductility, the information appears to be sufficient to determine the bond strength in uniaxial tension, using LEFM concepts. 20 refs., 6 figs.

48878 (IS-M–637) **Structure of Au and Pt films on Pd(110): Deposition temperature and coverage dependent (1 times 2) and (1 times 3) reconstructions.** Schmitz, P.J. (Ames Lab., IA (USA)); Kang, H.C.; Thiel, P.A.; Leung, W.Y. Ames Lab., IA (USA). [1990]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. (CONF-9007131–2: 3. international conference on the structure of surfaces, Milwaukee, WI (USA), 9-12 Jul 1990). Order Number DE90018045. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We present the results of a LEED study of the structures of Au and Pt films grown on Pd(110). We observe both (1×2) and (1×3) overlayer structures depending upon the coverage and deposition temperature. We explain the coverage and deposition temperature dependence of these reconstructions in terms of basic factors which control film growth processes.

48879 (IS-M–638) **A theoretical investigation on structural, vibrational, and electronic properties of amorphous silicon.** Soukoulis, C.M.; Biswas, R. Ames Lab., IA (USA). [1989]. 21p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research; National Science Foundation. DOE Contract W-7405-ENG-82. (CONF-8907216–1: 2. international workshop of non-crystalline solids, San Sebastian (Spain), 11-15 Jul 1989). Order Number DE90018040. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Amorphous silicon (a-Si) structures have been generated by quenching liquid silicon configurations using molecular-dynamics simulations. Localized vibrational modes have been identified in these amorphous silicon models. The densities of states and dynamic structure factors for localized, resonant, and extended modes are discussed and compared with neutron scattering data. Voids of various sizes have been introduced into a-Si models. The voids lead to a rapidly increasing structure factor below 1 $Å^{-1}$, similar to the intense small wave vector Guinier scattering observed in experiment. The presence of voids decreases the local strain in the a-Si network and substantially reduces the number of 5-coordinated sites from the a-Si model without voids. Finally, the electronic structure of these realistic a-Si models have been calculated with empirical tight binding parameters. An a-Si model that has only 4-coordinated atoms displays an electronic density of states (DOS) in good agreement with experiment, including an energy gap similar to that of the crystal. For models containing 3- and 5-coordinated defect sites, structural relaxation of the a-Si model using molecular dynamics was important in producing a gap. The electronic DOS of a-Si models that contain 3- and 5-coordinated defect sites will be presented. 47 refs., 12 figs., 2 tabs.

48880 (IS-M–646) **Analysis of deformation characteristics of a heavily deformed Cu- 20%Nb composite.** Biner, S.B.; Spitzig, W.A. Ames Lab., IA (USA). [1989]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. (CONF-891024–9: The Metallurgical Society fall meeting: materials week, Indianapolis, IN (USA), 1-5 Oct 1989). Order Number DE90018041. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this study, the deformation and strengthening behavior of a Cu-Nb composite is simulated by using an elastic-plastic finite element analysis. Results indicate that a whisker strengthening mechanism due to the Nb filaments behaving as whiskers is not sufficient to increase the strength level of the composite to the observed strength level. To predict the measured strength levels some portion of the Cu matrix should have a strength level as high as the theoretical strength of Cu, in agreement with predictions from an earlier analysis based on the Hall-Petch relation. 11 refs., 9 figs.

48881 (IS-T–1474) **Physical metallurgy and magnetic behavior of Cd stabilized bcc (beta)Gd alloys.** Jinke, Tang. Ames Lab., IA (USA). 21 Sep 1990. 53p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE91000196. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

As a continuation of the research on bcc Gd-Mg alloy system by Herchenroeder and Gschneidner, the metastable bcc Gd-Cd alloys were studied with the emphasis on their metallurgical and magnetic properties. An essentially single phase alloy could be retained for Cd concentrations from 15 at. % Cd to 19 at. % Cd, which is in the vicinity of the eutectoid composition of βGd in the Gd-Cd system. The lattice constants obtained for these alloys were used to determine the lattice constant of pure bcc Gd by extrapolation to 0 at. % Cd. Good agreement between this extrapolated value and that obtained from Gd-Mg alloys by using the same method suggested the validity of such extrapolation method. Thermal stability of these metastable bcc Gd-Cd alloys was examined by using differential thermal analysis (DTA).

48882 (JAERI-M–90-061) **Effects of environment and aging on creep properties of Alloy 800H.** Watanabe, Katsutoshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Tsuji, Hirokazu; Nakajima, Hajime; Tanabe, Tatsuhiko; Hiraga, Keijiro; Sakai, Yoshikazu; Shiraishi, Haruki. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 38p. (In Japanese). Order Number DE90520207. Source: NTIS (US Sales Only), PC A03/MF A01.

A series of creep tests were conducted at temperatures ranging from 750 to 900degC on a Fe-base heat-resistant alloy, Alloy 800H, which would be used for the cladding material of the neutron absorber rods of the High-Temperature Engineering Test Reactor. The maximum rupture life was 3552 h. In those tests the effects of environment and aging on its creep properties were studied. The obtained results are as follows: (1) No significant difference in creep rupture strength, creep ductility and creep deformation resistance was observed between in HTGR helium and in air. The creep rupture strength in HTGR helium and in air had no difference from that obtained in pure argon with a remote controlled creep testing machine which would be used for the evaluation of irradiation effect, neither. (2) These was no notable difference in creep rupture strength, creep ductility and creep deformation resistance among three different heat treated materials, i.e., solution annealed at 1120degC for 1 h, solution annealed at 1120degC for 1 h and then aged at 700degC for 530 h, and solution annealed at 1120degC for 1 h and then aged at 1050degC for 3 h. (3) The creep rupture strength obtained in the present work was situated within the scatter range of the available data in literature. (author).

48883 (K/CSD/INF–89/42/R1) **The linear solution for hydriding of uranium.** Kirkpatrick, J.R. (Oak Ridge Gaseous Diffusion Plant, TN (USA)); Condon, J.B. Oak Ridge Gaseous Diffusion Plant, TN (USA). [1990]. 16p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OT21400. (CONF-9009141–2-Rev.1: International symposium on metal-hydrogen systems, Banff (Canada), 2-7 Sep 1990). Order Number DE90017702. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A set of equations describing the hydriding of solid pieces of uranium is presented, together with an approximate solution of the equations. The solution predicts a constant velocity of the spall front in the solid piece, which leads to a constant value of weight gain rate (or other measure of the extent of the hydriding reaction) for a portion of the duration of the measurement. The solution allows calculation of the spall front velocity, and thus of the constant reaction rate, from expressions that are closed-form with the exception of one simple numerical integration. Expressions are given for all of the parameters needed to calculate reaction rates for well-annealed samples of uranium. Calculated reaction rates are compared with published data taken at a hydrogen pressure of 1.0 atmospheres. The calculated results match the data quite well. 9 refs., 2 figs.

48884 (KFTI–88-33) **Island structure growth and continuous film production criteria. 1. Weak atom sources.** Koropov, A.V.; Sagalovich, V.V. AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst. 1988. 12p. (In Russian). Order Number DE91601512. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

In the approximation of self-consistent average field growth of different geometry (sphere segment with arbitrary edge Θ, cylinder) islands under different atom transport mechanism is considered. In case of weak atom sources the mean islands radius R-bar(t) grows and their density N(t) decreases, the problem on continuous film production is defined by concurrence of atomic sources and transport processes in island film. Asymptotic time dependence for average film thickness d-bar, coefficient of substrate filling with Z islands, efficient filling coefficient Z are obtained. Criteria of change from island structure growth to continuous film growth regime (substrate overfilling with islands) are determined. As a particular case growth of hemispherical islands of radius $R >> \lambda_S$ (λ_S ($D_S\tau_S$)$^{1/2}$ - adsorbed atom diffusion length) in sufficiency dense inert gas medium when adsorbed atom diffusion fields are adjusted to vapor diffusion fields are considered. 18 refs.; 1 fig.

48885 (KFTI–88-41) **Island structure growth and continuous film production criteria. 2. Strong atom sources.** Koropov, A.V.; Sagalovich, V.V. AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst. 1988. 11p. (In Russian). Order Number DE91601513. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

In the approximation of self-consistent average field growth of different geometry (sphere segment with arbitrary edge angle Θ, cylinder) islands under different atom transport mechanisms is considered. In case of strong sources the mean islands radius R-bar(t) but their density N_0=const and with time change from island structure growth to continuous growth regime takes place. Asymptotic time dependence for mean film thickness d-bar(t) coefficient of substrate filling with Z(t) islands, efficient filling coefficient Z-tilde as well as estimations for the time of substrate filling with islands t_3 and average overfilling thickness d-bar$_3$ are obtained. As a particular case growth of hemispheric islands of $R >> \lambda_s$ radius (λ_s ($D_s\tau_s$)$^{1/2}$ - adsorbed atom diffusion length) in rather dense inert gas medium when adsorbed atom diffusion fields are adjusted to vapour fields is considered. 10 refs.; 1 tab.

48886 (LA–11895-MS) **Implementation and assessment of the mechanical-threshold-stress model using the EPIC2 and PINON computer codes.** Maudlin, P.J.; Davidson, R.F.; Henninger, R.J. Los Alamos National Lab., NM (USA). Sep 1990. 62p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-36. Order Number DE90017855. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

A flow-stress constitutive model based on dislocation mechanics has been implemented in the EPIC2 and PINON continuum mechanics modes. This model provides a better understanding of the plastic deformation process for ductile materials by using an internal state variable called the mechanical threshold stress. This kinematic quantity tracks the evolution of the material's microstructure along some arbitrary strain, strain-rate, and temperature-dependent path using a differential form that balances dislocation generation and recovery processes. Given a value for the mechanical threshold stress, the flow stress is determined using either a thermal-activation-controlled or a drag-controlled kinetics relationship. We evaluated the performance of the Mechanical Threshold Stress (MTS) model in terms of accuracy and computational resources through a series of assessment problems chosen to exercise the model over a large range of strain rates and strains. Our calculations indicate that the more complicated MTS model is reasonable in terms of computational resources when compared with other models in common hydrocode use. In terms of accuracy, these simulations show that the MTS model is superior for problems containing mostly normal strain with shear strains less than 0.2 but perhaps not as accurate for problems that contain large amounts of shear strain. 29 refs., 33 figs., 9 tabs.

48887 (LA-UR–90-2828) **Accurate representations of general textures by a set of weighted grains.** Kocks, U.F. (Los Alamos National Lab., NM (USA)); Kallend, J.S.; Biondo, A.C. Los Alamos National Lab., NM (USA). [1990]. 7p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-36. (CONF-9009236–1: 9. international conference on textures of materialss, Avignon (France), 17-21 Sep 1990). Order Number DE90016487. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The most compact way of describing general texture information is by way of a file of weighted discrete grains. When the textures are strong, this results in a great saving of necessary parameters. The most efficient way is a random file from which grains with low weights get discarded. This method is routine and independent of any preknowledge of the texture or even the symmetries. Typically, the order of 100 grains are sufficient for strong textures or fiber textures. Furthermore, these grains files are directly in the kind of format that is useful for computer simulation of current anisotropic properties or future texture development. For textures that are not very sharp, but nevertheless are not properly represented as random (which would imply isotropic properties), one may also use weighted-grains files, but here the number of grains needed may be large for an accurate representation. We have found that on the order of 1000 weighted grains are sufficient for most cases. When the symmetries are known, grains that are regularly (rather than randomly) arranged in orientation space are useful – again better when they are weighted.

48888 (LBL–26455, pp. 220) **Novel materials from nanocrystalline aggregates.** Dahmen, U.; Westmacott, K.H. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Materials with extremely small grain size, in the range from a few Angstroms to a few hundred Angstroms, are termed nanocrystals or nanocomposites. By virtue of their very high grain-boundary area, such materials show unusual properties such as greatly enhanced diffusivity, low sintering temperatures, limited grain growth, and shifts in magnetic properties. Nanocomposites with a narrow range of size distributions and with varying degrees of texture are of particular interest because of their potential for controllable packing density and anistropy. Ceramic materials of this nature can be produced by thermal-decomposition reactions. The resulting porous microstructure may be considered a composite of small oriented crystallites (nanocrystals) and pores. The highest degree of texture is obtained by ionized-cluster beam deposition of metals on a single-crystal substrate, a technique that allows formation of thin films with unique continuous bicrystal structure. The purpose of this program is to explore new materials synthesized from ultrafine grains (nanocrystals) or clusters, to study the potential for producing novel microstructures with unique properties, and to conduct a detailed microstructural investigation to understand effects of processing variables.

48889 (LBL–26455, pp. 223) **Search for nonphonon mechanisms of superconductivity.** Kihlstrom, K.E.; Hovda, P.D.; Kresin, V.Z.; Wolf, S.A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The authors present the results of a quantitative test to separate phonon from nonphonon contributions to the superconductivity in A-15 (Nb_3Ge). This test is based on analysis of heat capacity, tunneling a $^2F(\omega)$ data, and neutron-scattering. The authors obtained evidence for a substantial contribution of a nonphonon mechanism to the superconducting state in Nb_3Ge. In contrast, their results suggest the superconducting state in Pb and V_3Si is due to phonons.

48890 (LBL–26455, pp. 226) **A cold model study of wear on fluidized bed combustor tubes.** Levy, A.V. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Energy production from the fluidized bed combustion of coal has many advantages over conventional coal burning methods. A large reduction in emission of the pollutants NO_x and SO_x, as well as a high combustion efficiency and wider fuel tolerance, make fluidized

bed combustion an attractive technology. A significant problem encountered in the burning of coal by this process has been the material wastage of heat exchanger tubes and other components immersed in the fluidized bed. A major probable contribution to heat exchanger tube waste in bubbling fluidized beds is mechanical in nature. It arises from the impact of aggregates of defluidized particles thrown against tube undersides during either the passage of rising bubbles, or the collapse of teardrop like voids that form periodically under the tubes. In an effort to investigate this process, isolated from other erosive or corrosive effects, a novel wear testing rig has been designed and built. This device simulates the particle aggregate impact environment by the fast movement of a specimen rod vertically within a minimally fluidized bed.

48891 (LBL–26455, pp. 226) **Work in progress.** MacAdam, S. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Tests conducted during a cold model study indicate that the device reproduces most aspects of the tube wastage in bubbling beds. Wear rates and distributions for a wide variety of metallic and plastic materials were very similar to those found in other cold wear studies that utilized conventional fluidized beds. The mechanism of material removal was found to be one of a combination of micromachining and plowing due to the dragging of partially constrained particles across the tube surface. Wear resistance was found to increase linearly with the hardness of pure annealed metals, but was not affected by hardness induced through heat treatment. The type of particle used as the bed material had a major effect on wear behavior. The degree of particle rounding and the nature of the particle debris governed wear. Silicon carbide particles became round but primarily produced debris larger than 1 μm, which did not form any protective layer on the tube surface. Quartz remained relatively sharp throughout testing and resulted in the greatest wear, even though a partially protective submicron particle layer did form. A new testing rig of basically the same design has been constructed that will operate at the elevated temperatures characteristic of in-bed tubes in fluidized bed combustors. The combined effects of wear and corrosion in this environment will be studied over the next two years to develop a fundamental understanding of the system and to suggest means of reducing tube material wastage.

48892 (N–90-24350, pp. 37-43) **Thermal conductivity of metals.** Kazem, S.M. National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center. May 1990. (NASA-CP–3074;L–16785;NAS–1.55:3074;CONF-8910299–: National Educators workshop, Norfolk, VA (USA), 17-19 Oct 1989). In *National Educators' workshop: Update 1989 standard experiments in engineering materials science and technology.* Source: NTIS, PC A09/MF A02.

The objective is to familiarize students with steady and unsteady heat transfer by conduction and with the effect of thermal conductivity upon temperature distribution through a homogeneous substance. The elementary heat conduction experiment presented is designed for associate degree technology students in a simple manner to enhance their intuition and to clarify many confusing concepts such as temperature, thermal energy, thermal conductivity, heat, transient and steady flows. The equipment set is safe, small, portable (10 kg) and relatively cheap (about $1200): the electric hot plate 2 kg (4.4 lb) for $175: the 24 channel selector and Thermocouple Digital Readout (Trendicator) 4.5 kg (10 lb) for about $1000; the three metal specimens (each of 2.5 cm diameter and 11 cm length), base plate and the bucket all about 3 kg (7 lb) for about $25. The experiment may take from 60 to 70 minutes. Although the hot plate surface temperature could be set from 90 to 370 C (maximum of 750 watts) it is a good practice to work with temperatures of 180 to 200 C (about 400 watts). They may experiment in squads of 2, 3 or even 4, or the instructor may demonstrate it for the whole class.

48893 (N–90-24405) **Corrosion fatigue crack propagation in metals.** Gangloff, R.P. Virginia Univ., Charlottesville, VA (USA). Jun 1990. 202p. (NASA-CR–4301;NAS–1.26:4301;CONF-8809496–: 1. international conference on environment induced cracking of metals, Kohler, WI (USA), Sep 1988). Source: NTIS, PC A10/MF A02.

This review assesses fracture mechanics data and mechanistic models for corrosion fatigue crack propagation in structural alloys exposed to ambient temperature gases and electrolytes. Extensive stress intensity-crack growth rate data exist for ferrous, aluminum and nickel based alloys in a variety of environments. Interactive variables (viz., stress intensity range, mean stress, alloy composition and microstructure, loading frequency, temperature, gas pressure and electrode potential) strongly affect crack growth kinetics and complicate fatigue control. Mechanistic models to predict crack growth rates were formulated by coupling crack tip mechanics with occluded crack chemistry, and from both the hydrogen embrittlement and anodic dissolution/film rupture perspectives. Research is required to better define: (1) environmental effects near threshold and on crack closure; (2) damage tolerant life prediction codes and the validity of similitude; (3) the behavior of microcrack; (4) probes and improved models of crack tip damage; and (5) the cracking performance of advanced alloys and composites.

48894 (ND-M–3888(S)) **Effects of cathodic protection potential and stress ratio on fatigue thresholds of structured steels in sea water.** Dolphin, A.S.; Tice, D.R. UKAEA Springfields Nuclear Power Development Labs. (UK). Sep 1987. 27p. Source: Available from British Library, Document Supply Centre, Boston Spa, Wetherby, West Yorks.

The results reported here suggest that the very high thresholds found under reducing ΔK conditions may be inapplicable under the increasing ΔK conditions likely to be more relevant to real structures. This conclusion is based on just two tests at - 0.85V SCE, and so requires confirmation over a range of R ratios and at free corrosion and overprotection potentials. Crack growth thresholds appear to be higher under cathodic over-protection conditions (-1.05V SCE) than at more positive potentials, due to calcareous scale formation. Tests at negative R ratios are required to ensure this calcarecus scale would remain intact under compressive loading. Due to the large observed influence of calcareous scale on crack growth, and particularly on the arrest of growing cracks, more detailed microstructural examination is recommended on the specimens tested in this programme. (author).

48895 (OH/RD–89-306-K) **Trip report: International Congress on Applications of Lasers and Electro-Optics, Oct. 16-19, 1989, Orlando, Florida.** Mannik, L. Ontario Hydro, Toronto, ON (Canada). Research Div. 19 Dec 1989. 8p. (MICROLOG–90-04002). Source: PC Ontario Hydro Research Division, Editorial Section, 800 Kipling Ave., Toronto, Ont., CAN M8Z 5S4; MF CAN-MET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

A general summary is provided of a 1989 meeting on lasers and electro-optics. The program of papers was highlighted by developments in very high power laser processing and the search for alternatives to the carbon dioxide laser as a materials processing source. Both of these developments promise improved energy conservation in the form of higher electrical efficiencies for materials processing. Specific alternates to the CO_2 laser included the Nd-Y-Al-garnet laser, the CO laser, and the chemical oxygen-iodine laser. Applications discussed include surface modification, cutting and welding of ferrous and nonferrous metals, and laser welding of automotive parts. 2 refs.

48896 (ORNL/FTR–3721) **[Defects in close-packed metals and alloys]: Foreign trip report, August 9, 1990–August 22, 1990.** Yoo, M.H. Oak Ridge National Lab., TN (USA). 30 Aug 1990. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90017502. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The International Conference on Defects in Hexagonal Close-Packed Metals was held to assess our current understanding of the structures and properties of lattice defects in hexagonal close-packed (hcp) materials and to outline future directions of research in this field. Fourteen keynote overview lectures and 18 additional lectures covering more specific topics were presented by researchers from 13 countries. The traveler presented a keynote lecture on deformation twinning in hcp metals and alloys. While in Trieste, the traveler acquired the research highlights on lattice defects and mechanical properties of metals and alloys in Europe.

48897 (SAND–90-2108C) **Solderability of environmentally exposed Sn-plated surfaces.** Hosking, F.M.; Sorensen, N.R. Sandia National Labs., Albuquerque, NM (USA). [1990]. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900854–1: 3. electronic materials and processing congress, San Francisco, CA (USA), 20-24 Aug 1990). Order Number DE91000035. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Solderability of Class II environmentally exposed Ni-Sn plated Cu substrates was evaluated with 60Sn-40Pb solder. Tin thickness were 10, 50, and 150 μin. The 10 μin. plating gave the smallest solder meniscus rise. A general decrease in contact angle, or increase in wettability, was observed with increasing Sn plating. The environmental exposures retarded the wetting rate and increased the time to maximum wetting, particularly with only 10 μin. of Sn. Although the solderability of the 50 and 150 μin. surfaces were not significantly affected by the test conditions, an intermediate plating thickness of 100 μin. is preferred for processing flexibility. 13 refs., 6 figs., 1 tab.

48898 (UCRL-JC–104721) **High-resolution electron microscopy observations of athermal omega phase in Ti-Mo alloys.** Schryvers, D. (Antwerp Univ., Wilrijk (Belgium)); Tanner, L.E. Lawrence Livermore National Lab., CA (USA). 26 Jun 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-8907114–4: International conference on martensitic phase transformations (ICOMAT-89), Sydney (Australia), 3-7 Jul 1989). Order Number DE90017526. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The commensurate and incommensurate structural configurations underlying the diffuse scattering from athermal ω found in the as-quenched β phase of Ti with 8 and 15 at. % Mo have been investigated by high-resolution electron microscopy. Image interperetations were based on a simulation code developed via observed images of the commensurate ω phase formed by annealing Ti-8 at. % Mo. Athermal ω is observed as linear structural arrays or "strings" of <1.5 nm length. When commensurate (in quenched Ti-8 at. % Mo), the strings are confined (111) directions which are parallel to the longitudinal displacement wavevector associated with this phase transformation. However, when the athermal ω is incommensurate (in quenched Ti-15 at. % Mo), the strings tend to deviate from this direction. Atomic models for one- and two-dimensional transition structures are proposed. 17 refs., 8 figs.

48899 Analytical electron microscopy studies of radiation damage. Kenik, E.A. (Oak Ridge National Lab., TN (USA). Metals and Ceramics Div.). *Metallurgical Transactions, A (Physical Metallurgy and Materials Science) (USA),* 20(12): 2663-2672 (Dec 1989).

Analytical electron microscopy (AEM) has provided structural, crystallographic, and compositional characterization to aid in the understanding of radiation damage processes, especially in multiphase materials. The range of AEM techniques is based on the use of as many of the signals produced by the interaction of an electron beam with a specimen as possible. This paper discusses the origins, capabilities, and current developments of AEM, including the spatial resolution of various techniques. Several applications of AEM in radiation damage studies, including radiation-induced segregation and phase instability in austenitic stainless steels, are reviewed. From the comparison of phase equilibria under irradiation to that under thermal aging, principles for alloy development in non-nuclear applications are discussed.

48900 Irradiation-enhanced and-induced mass transport. Rehn, L.E. (Argonne National Lab., IL (USA). Materials Science and Technology Div.). *Metallurgical Transactions, A (Physical Metallurgy and Materials Science) (USA),* 20(12): 2619-2626 (Dec 1989).

Irradiation can be used to enhance diffusion, that is, to increase the rate at which equilibrium is attained, as well as to induce nonequilibrium changes. The main factors influencing whether irradiation will drive a material toward or away from equilibrium are the initial specimen microstructure and geometry, irradiation temperature, and primary recoil spectrum. This paper summarizes known effects of irradiation temperature and primary recoil spectrum on mass transport during irradiation. In comparison to either electron or heavy-ion irradiation, it is concluded that relatively low-energy, light-ion bombardment at intermediate temperatures offers the greatest potential to enhance the rate at which equilibrium is attained. The greatest departures from equilibrium can be expected from irradiation with similar particles at very low temperatures.

3602 Ceramics, Cermets, and Refractories

Refer also to citation(s) 48219, 48503, 48504, 48505, 48506, 48507, 48508, 48509, 48510, 48511, 48694, 48696, 48765, 48806, 48809, 48836, 48855, 48863, 48870, 48872, 48874, 48887, 48888, 48984, 49020, 49047, 49055, 49077, 49080, 49103, 49121, 49122, 49134, 49205, 49206, 49218, 49389, 50069, 50089

48901 (AD-A–221936/8/XAB) **Fabrication of composite high temperature superconductor wires from Ag/$YBa_2Cu_3O_x$ power produced by $AgNO_3$ decomposition.** Ferrando, W.A. Naval Surface Warfare Center, Silver Spring, MD (USA). 30 Mar 1990. 45p. (NSWC/TR–89-338). Source: NTIS, PC A03/MF A01.

A brief discussion of the history and generic properties of superconductors is given. Arguments favoring the use of microscopically uniform silver additions to the high temperature superconducting ceramic oxide powders are made. After treating some conventional Ag deposition methods and their shortcomings in this application, a novel, inexpensive method involving the decomposition of AgNO3 is presented. Conventional wire fabrication methods, as adapted to processing the high temperature superconductor materials, are discussed. Test equipment for measurement of the important superconducting properties of critical temperature (Tc) and critical current (Jc) is described. Finally, some early results on wire segments fabricated at the Naval Surface Warfare Center (NSWC) are given. (rh)

48902 (AD-A–222635/5/XAB) **Investigation of thermomechanical effects in silicon carbide whisker/Al alloy composites. Final report, 1 March 1985-31 August 1989.** Wawner, F.E.; Schueller, R.D. Virginia Univ., Charlottesville, VA (USA). Dept. of Materials Science. Jun 1990. 78p. Contract N00014-85-K-0179. (UVA–525398/MS90/104). Source: NTIS, PC A05/MF A01.

This program deals with determining factors that influence strength, ductility, and elongation to failure in SiC whisker/Al alloy composites. Specifically, a microstructural study was made in an attempt to define extrinsic and intrinsic factors that control fracture and thus influence properties. One of the more important products by ACMC from SiC/Al composites has been the rolled sheet. The response of the material to secondary processing and thermomechanical treatment is of utmost importance with respect to material quality. The present study emphasizes microstructural-mechanical property characterization of the rolled material.

48903 (AD-A–222853/4/XAB) **Growth and deformation mechanisms of refractory-alloy hybrid materials. Final report, September 1986-September 1989.** Sastry, S.M.; Schwartz, D.S.; Bodwen, D.M.; O'Neal, J.E. McDonnell Douglas Research Labs., St. Louis, MO (USA). Apr 1989. 69p. Contract F49620-86-C-0108. (MD-QA–052). Source: NTIS, PC A04/MF A01.

A major challenge in the development of dispersion-hardened alloys is to produce a high volume-fraction of the fine hardening particles. This challenge has been met through the use of Rapid Solidification Technology (RST). Application of RST to titanium alloys can produce oxide-dispersion-strengthened alloys having large volume-fractions of < or = 100 nanometers incoherent oxide dispersoids, and in situ composites containing high-modulus whisker/particulate reinforcements. These titanium alloys are a special class of refractory hybrid materials which have low density, yet have the high-temperature strength and stability required for use as hypersonic aircraft skins and structures. Oxide dispersions in RST Ti (Titanium) alloys are produced by Rapid Solidification Processing (RSP) and subsequent annealing of Ti/rare-earth alloys. Rapid solidification significantly increases the solid solubilities of rare-earth elements in Ti. Annealing causes the rare-earth elements to precipitate and scavenge in terstitial oxygen from the Ti matrix, forming rare-earth oxide dispersoids.

48904 (AD-A-222931/8/XAB) **Theory of ceramic/zirconia composites: Toughening, strengthening, and synergism.** Budiansky, B.; Stump, D.M. Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences. Apr 1990. 11p. Contracts N00014-86-K-0753, N00014-84-K-0510. (MECH-159). Source: NTIS, PC A03/MF A01.

A review is given of recent theoretical results concerning toughening and strengthening in brittle ceramics reinforced with dilatantly transforming zirconia particles. Small-scale analysis of long dominant cracks provides resistance curves that exhibit peak fracture toughnesses for finite amounts of crack growth. Similar results for the tensile fracture strengths of short cracks have implications for transformation strengthening. The interaction due to the presence of both transforming particles and ductile metal particles can result in synergistic reinforcing effects over a parametric range of material properties.

48905 (AD-A-223012/6/XAB) **International workshop on ion beam modification and processing of high-Tc superconductors: Physics and devices: Program and abstracts.** UKAEA Harwell Lab. (UK). Apr 1989. 36p. Contract DAJA45-88-M-0211. Source: NTIS, PC A03/MF A01.

Partial contents: Why is Superconducting Technology More Difficult the Second Time Around, Role of Ion Beams in Superconductor Research, Transport Properties of High Tc Superconductors, Irradiation Induced and Substitutional Disorder Effects in $YBa_2Cu_3O_7$, Anomalous Thermal Vibrational Behavior in (U,Er)Ba_2Cu_3O(7-delta), Defect Phenomena in Perovskites and Related Oxides: Parallels Between Superconducting and Conventional Oxides, Oxygen Disorder Effects in High Tc Superconductors, Magnetization of Neutron Irradiated YBCO Single Crystals, Transport Properties in Low Temperature Electron Irradiated High-Tc Superconductors, Stochastic Description of Compounds Stability Under Irradiation: Temperature, Flux and Cascade Size Effects, The Nature of Ion-Beam Induced Disorder in HTSC, Electron Microscopy of Defects and Interfaces in High-Tc Superconductors, Ion Beam Lithography of Thin Film High Temperature Superconductors, Ion Implantation-Making and Doping of Superconductors, Formation and Evolution of Ion Bean-Induced Extended Defects in RBaCuO and BiCaSr-CuO Superconductors: In Situ TEM Studies, Perspectives on High Temperature Superconducting Electronics, Laser Beam Patterning of YBa_2CuO_7 Thin Films, and Thin Film Preparation by Laser Ablation and Sputtering Without Post-Annealing, Abstracts, Symposia.

48906 (AD-A-223031/6/XAB) **Effect of interfacial characteristics on the mechanical performance of ceramic-ceramic composites. Final report, July 1986-December 1989.** Homeny, J.; Brown, S.D. Illinois Univ., Urbana, IL (USA). Feb 1990. 10p. Contract DAAL03-86-K-0121. Source: NTIS, PC A02/MF A01.

The research reported addresses several of the critical issues in the field of ceramic fiber (whisker) /ceramic matrix composites. The overall goal was to understand the complex relationships between processing, interfacial microstructure, and mechanical properties in order to engineer the overall performance of the composites. The composite systems of interest were: (1) SiC whisker/Al_2O_3 matrix composites, (2) beta-Si_3N_4 whisker/Si_3N_4 matrix composites, and (3) SiC continuous fiber/lithium-alumino-silicate matrix composites.

48907 (AD-P-005939/4/XAB) **Short-fibre and particulate-reinforced metal-matrix composites.** Harris, S.J. Nottingham Univ. (UK). Aug 1989. 13p. Source: NTIS, PC A03/MF A01.

This article is from Conference Proceedings of the Meeting of the Structures and Materials Panel of AGARD (67th) on New Light Alloys Held in Mierlo, Netherlands on 3-5 October, 1988, AD-A215 832, p25-1 thru 25-13. Availability: AGARD, Neuilly-Sur-Seine, France. No copies furnished by DTIC/NTIS.

Short fibres, whiskers or particles of ceramic materials, e.g. silicon carbide and alumina, when dispersed in a more or less random manner in a metallic matrix can promote increases in stiffness and strength at ambient and elevated temperatures without imposing a weight penalty. The paper considers the available routes for the fabrication of such composites, e.g. by squeeze casting, spray forming, powder technologies and hot working etc. Influences of type and amount of reinforcement, matrix alloy selection and processing route on strength, creep and fatigue resistance are discussed. Comparisons are made with conventional metals and alloys, and polymers and metals reinforced with continuous fibres. Attention is drawn to the behaviour of these materials under compressive loading as well as to their thermal expansion and conductivity. The majority of the matrices considered are aluminium-based.

48908 (AD-P-005940/2/XAB) **Metal-matrix composites - a promising alternative to conventional alloys.** Schulte, K.; Bunk, W. Deutsche Forschungsanstalt fuer Luft- und Raumfahrt e.V. (DLR), Koeln (Germany, F.R.). Bereich fuer Projekttraegerschaften. Aug 1989. 16p. Source: NTIS, PC A03/MF A01.

This article is from Conference Proceedings of the Meeting of the Structures and Materials Panel of AGARD (67th) on New Light Alloys Held in Mierlo, Netherlands on 3-5 October 1988, AD-A215 832, p26-1 thru 26-16. Availability: AGARD, Neuilly-Sur-Seine, France. No copies furnished by DTIC/NTIS.

Conventional metallic materials have been tailored in the past close to their ultimate properties. New technological requirements ask for further improved materials. Metal-Matrix Composites (MMC) promise to reach this goal. MMC (Metal-Matrix Composites) can be described as materials whose microstructure comprise a continuous metallic phase (the matrix) into which a second phase has been artificially introduced during processing, as reinforcement. Presently the interest in MMC is primarily focused on light alloys reinforced with a fibrous or particulate phases to achieve major jumps in selected mechanical properties or thermal stability. This new interest is mainly related to the fact that ceramic based reinforcement constituents became recently available, which are comparatively inexpensive. Al_2O_3- (Aluminum Oxide) or SiC (Silicon Carbide)-based fibres, whiskers and particles, but also carbon fibres are used to reinforce aluminium, magnesium or titanium matrix alloys.

48909 (CBPF-NF-043/86) **Study of the silica aerogel densifications by SAXS and BET.** Craievich, A.F. (Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil)); Santos, D.I. dos; Aegerter, M.A.; Lours, T.; Zarzycki, J. Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1986. 16p. (In Portuguese). Order Number DE91601676. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Silica gels were made by hydrolysis and polycondensation of solutions containing tetramethoxysilane (TMOS), methanol and water in a neutral medium. After hypercritical drying, the aerogels were densified at high temperatures (1080^0C). The obtained porous materials have apparent densities between 0,71 and 2,20 g/cm^3 and specific surfaces, measured by BET, below 295 m^2/g. The structural evolution of the porous material was studied by small-angle X-ray scattering (SAXS). There are two competitive mechanisms that contribute to Densification: the elimination and coalescence of mesopores, and the progressive densification of the nearly homogeneous vitreous matrix. (author).

48910 (CONF-891119-140) **Superconducting and structural properties of the ($Ba_{0.6}K_{0.4}$) ($Bi_{1-y}Sb_y$)O_3 system.** Dabrowski, B. (Argonne National Lab., IL (USA)); Pei, S.; Richards, D.R.; Zheng, Y.; Jorgensen, J.D.; Hinks, D.G.; Mitchell, A.W.; Kimball, C.W. Argonne National Lab., IL (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Grant STC-880984(BD,SP);Grant DMR-87-19738(CWK). From Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989. Order Number DE90017836. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Single-phase samples of ($Ba_{1-x}K_x$) ($Bi_{1-y}Sb_y$)O_3 have been synthesized over a limited compositional range using a two-step procedure: high-temperature firing in a low oxygen partial pressure followed by low-temperature oxygen annealing. For y=0 and 0.37< x <0.50, samples have a simple cubic structure and are bulk superconductors with $T_c$gradually decreasing from 30 to 22K as x increases to 0.50. For fixed x and y>0 samples are superconducting again with a simple cubic structure and with $T_c$gradually decreasing as y increases. 8 refs., 1 fig.

48911 (CONF-900577-3) **Computer-controlled ion beam deposition systems for high T_c superconductor and other multi-component oxide thin films and layered structures.** Krauss, A.R. (Argonne National Lab., IL (USA)); Gruen, D.M.; Auciello, O.; Kingon, A.I.; Ameen, M.S.; Graettinger, T.M.; Rou, C.S.; Soble, C.S.; Liu, Y.L.; Barr, T. Argonne National Lab., IL (USA).

[1990]. 13p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research; National Science Foundation. DOE Contract W-31109-ENG-38. From Symposium on surface processing and laser assisted chemistry in conjunction with the spring meeting of the European Materials Research Society; Strasbourg (France); 29 May - 1 jun 1990. Order Number DE90017798. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A single beam, multiple target (SBMT) deposition system which features a rotating target holder with either elemental or simple compound targets has been developed for the production of layered thin film structures and multicomponent oxide, silicide or other compound thin films. We are employing the SBMT ion beam sputtering system for the deposition of high temperature superconducting films and electro-optical multilayer structures. The beam-target-substrate geometry and ion beam characteristics are designed to minimize beam implantation and secondary sputtering effects, while maintaining high deposition rates. Consequently, the amount of energy which is deposited into the film may be controlled providing enough energy to promote activated processes, such as the in-situ formation of oriented crystal structures of high temperature superconducting materials, while minimizing amorphization and gas incorporation. All parameters necessary to control the film properties are under computer control. A deposition cycle, defined as a number of sequential steps may be easily modified or added to previously existing deposition cycles, thereby permitting the creation of complicated deposition procedures suitable for he production of films with highly reproducible properties for research purposes, and the in-situ fabrication of complex devices for technological applications. Examples are given of the capabilities of the technique as they apply to the production of high T_c superconducting devices.

48912 (CONF-900731–2) **Indentation testing of thin films and hard materials.** McHargue, C.J. Oak Ridge National Lab., TN (USA). [1990]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From NATO Advisory Study Institute on diamond and diamond-like films; Castelvecchio Pascoli (Italy); 22 Jul - 2 aug 1990. Order Number DE90017758. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Indentation testing techniques can provide important information about the near-surface mechanical and deformation properties of solids. Properly executed and interpreted, such techniques can provide information regarding hardness, elastic modulus, compressive yield strength (for metals), fracture toughness (in ceramics) and residual stresses (in ceramics). However, the apparent simplicity of the test procedures often believe the difficulties of obtaining quantitative information of specific properties of interest. This report discusses indentation test techniques for the testing of thin films or coatings.

48913 (CONF-900813–1) **Excess oxygen defects in layered cuprates.** Lightfoot, P. (Argonne National Lab., IL (USA)); Pei, S.Y.; Jorgensen, J.D.; Manthiram, A.; Tang, X.X.; Goodenough, J.B. Argonne National Lab., IL (USA). Sep 1990. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Contract STC-88-09854. From International conference on the chemistry of electronic ceramic materials; Grand Teton National Park, WY (USA); 16-21 Aug 1990. Order Number DE90017669. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Neutron powder diffraction has been used to study the oxygen defect chemistry of two non-superconducting layered cuprates, $La_{1.25}Dy_{0.75}Cu_{3.75}F_{0.5}$, having a T*- related structure, and $La_{1.85}Sr_{1.15}Cu_2O_{6.25}$, having a structure related to that of the newly discovered double-layer superconductor $La_{2-x}Sr_xCaCu_2O_6$. The role played by oxygen defects in determining the superconducting properties of layered cuprates is discussed. 16 refs., 2 figs.

48914 (CONF-900819–1) **$YBa_2Cu_3O_x$ superconductor coil: Processing and properties.** Dorris, S.E.; Dusek, J.T.; Picciolo, J.J.; Russell, R.A.; Singh, J.P.; Poeppel, R.B. Argonne National Lab., IL (USA). May 1990. 6p. Sponsored by U.S. DOE Conservation & Renewable Energy; National Science Foundation. DOE Contract W-31109-ENG-38. Contract STC-8809854. From International conference on electric machines; Cambridge, MA (USA); 13-15 Aug 1990. Order Number DE90017791. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Fabrication of multilayer superconductor coils using $YBa_2Cu_3O_x$ (YBCO) will be described. In particular, three important aspects will be discussed: Heat treatment of the coils at reduced total pressure to avoid decomposition of the superconductor, application of Y_2BaCuO_5 (211) as an insulator that is chemically compatible with YBCO during firing, and addition of silver to YBCO to improve its mechanical properties. The superconducting properties of representative coils will be presented.

48915 (CONF-900830–2) **Epitaxial TiO_2 and VO_2 films prepared by MOCVD [metal-organic chemical vapor deposition].** Chang, H.L.M.; You, H.; Guo, J.; Lam, D.J. Argonne National Lab., IL (USA). Aug 1990. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 5. international conference on solid films and surfaces; Providence, RI (USA); 13-17 Aug 1990. Order Number DE90017806. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Titanium and vanadium oxide systems were selected to study the growth of thin epitaxial film in a metal-organic chemical vapor deposition (MOCVD) process. Epitaxial TiO_2 and VO_2 films were obtained on sapphire ($11\bar{2}0$), (0001), and ($1\bar{1}02$) but not on Si(111). Eight distinct substrate-film epitaxial relationships have been determined by x-ray diffraction studies using a four-circle diffractometer. It was found that none of the eight epitaxial systems had a good lattice match between substrate and film. But further investigation revealed that substantial similarity existed in the local atomic patterns of the substrate and the film for all these systems. Nevertheless, it should be emphasized that mismatches of the local atomic patterns for these systems are, in general, substantially larger than those observed in the epitaxial systems containing semiconductor materials such as silicon and GaAs. 11 refs, 4 figs.

48916 (CONF-901109–4) **$YBa_2Cu_3O_x$ composites with improved toughness and strength.** Singh, J.P.; Leu, H.J.; Kullberg, M.L.; Poeppel, R.B.; Goretta, K.C. Argonne National Lab., IL (USA). Apr 1990. 15p. Sponsored by U.S. DOE Conservation & Renewable Energy; U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers; Dallas, TX (USA); 25-30 Nov 1990. Order Number DE90011180. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Composite $YBa_2Cu_3O_x$/Ag superconductors were cast into thin tapes. Tapes containing 15 volume % Ag were 2 to 2.5 times stronger than monolithic $YBa_2Cu_3O_x$ tapes and had higher fracture toughnesses. The tapes containing Ag flakes were stronger than those containing Ag powder, possibly because of effects of preferred orientation. The superconducting properties of the tapes were not appreciably affected by Ag addition. Composite bars of $YBa_2Cu_3O_x$ and 10 mole % ZrO_2 coated with Y_2BaCuO_5 were found to have double the fracture toughness of unreinforced $YBa_2Cu_3O_x$. Strength was unaffected by ZrO_2 addition, however, because of differences in flaw populations. 16 refs., 4 figs., 1 tab.

48917 (INS–826) **Magnetic properties of Hubbard-sigma model with three-dimensionality.** Yamamoto, Hisashi; Tatara, Gen; Ichinose, Ikuo; Matsui, Tetsuo. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. May 1990. 55p. Order Number DE90520336. Source: NTIS (US Sales Only), PC A04/MF A01.

It has been broadly accepted that the magnetism may play an important role in the high-T_c superconductivity in the lamellar CuO_2 materials. In this paper, based on a Hubbard-inspired CP^1 or S^2 nonlinear σ model, we give a quantitative study of some magnetic properties in and around the Neel ordered state of three-dimensional quantum antiferromagnets such as La_2CuO_4 with and without small hole doping. Our model is a (3+1) dimensional effective field theory describing the low energy spin dynamics of a three-dimensional Hubbard model with a very weak interlayer coupling. The effect of hole dynamics is taken into account in the leading approximation by substituting the CP^1 coupling and the spin-wave velocity with 'effective' ones determined by the concentration and the one-loop correction of hole fermions. Stationary-phase equations for the one-loop effective potential of S^2 model are analyzed. Based on them, various magnetic properties of the system, such as the behavior of Neel temperature, spin

correlation length, staggered magnetization, specific heat and susceptibility as functions of anisotropic parameter, temperature, etc. are investigated in detail. The results show that our anisotropic field theory model with certain values of parameters gives a good description of the magnetic properties in both the ordered and the disordered phases indicated by experiments on La_2CuO_4. The part of the above results is supported by the renormalization-group analysis. In the doped case it is observed that the existence of holes destroys the long-range order and their hopping effect is large. (author).

48918 (IS-M–630) **The upper critical field of $HoBa_2Cu_3O_{7-\delta}$ for H || c.** Schwartzkopf, L.A.; Fang, M.M.; Chumbley, L.S.; Finnemore, D.K. Ames Lab., IA (USA). [1988]. 2p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. (CONF-880206–18: International conference on high temperature superconductors and materials and mechanisms of superconductivity, Interlaken (Switzerland), 29 Feb - 4 mar 1988). Order Number DE90016708. Source: NTIS, PC A02/MF A01 - OSTI.

The upper critical field H_{c2} of a grain-aligned $HoBa_2Cu_3O_{7-\delta}$ specimen has been measured as a function of temperature near the critical temperature, T_c, for applied field H || c. H_{c2} exhibited a $(1-T/T_c)^{1/2}$ temperature dependence, which is expected for a thin-film superconductor. This lends support to the idea that the superconducting pair potential is changed near twinning planes in $HoBa_2Cu_3O_{7-\delta}$. 7 refs., 3 figs.

48919 (IS-M–631) **Characterizing closure asperities by ultrasonic measurements.** Thompson, R.B.; Van Wyk, L.; Rehbein, D.K.; Tsai, Y.M.; Buck, O. Ames Lab., IA (USA). [1989]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. (CONF-890310–6: 7. international conference on fracture (ICF-7), Houston, TX (USA), 20-24 Mar 1989). Order Number DE90016709. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

It has recently been shown that considerable information about the topology of contacting asperities on the faces of fatigue cracks can be obtained from ultrasonic measurements. The particular configuration of interest is that of a fatigue crack in a compact tension specimen, illuminated at normal incidence by a longitudinal elastic wave. Previous work has suggested that the number density and dimensions of the contacts can be deduced from measurements of the frequency and spatial variations of the scattered elastic wave fields. This paper uses an analysis of the spatial Fourier transform of the dynamic crack opening displacement to interpret those conclusions and analyze several recent experimental results. 13 refs., 5 figs.

48920 (IS-M–632) **Granular and superconducting-glass properties of the high-temperature superconductors.** Clem, J.R. Iowa State Univ. of Science and Technology, Ames, IA (USA). [1988]. 7p. Sponsored by U.S. DOE Energy Research; Electric Power Research Institute. DOE Contract W-7405-ENG-82. (CONF-880206–17: International conference on high temperature superconductors and materials and mechanisms of superconductivity, Interlaken (Switzerland), 29 Feb - 4 mar 1988). Order Number DE90016710. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The microstructure of bulk samples of the copper-oxide high-temperature superconductors commonly is describable in terms of anisotropic grains of stoichiometric material separated by layers of nonstoichiometric interface material. The granularity strongly influences the electromagnetic properties, especially the transport critical-current density and the magnetization. In this paper, a simple theoretical model for the granularity is introduced and then used to discuss a number of electrodynamic properties (hysteric magnetization versus magnetic field, zero-field-cooled and field-cooled magnetization versus temperature, ac susceptibility and flux creep with logarithmic time dependence). Special attention is drawn to the importance of distinguishing between intragranular and intergranular effects. 27 refs.

48921 (IS-M–633) **Thermodynamic critical field of $Y_1Ba_2Cu_3O_7$.** Finnemore, D.K. (Ames Lab., IA (USA)); Fang, M.M.; Clem, J.R.; McCallum, R.W.; Ostenson, J.E.; Ji, Li; Klavins, P. Ames Lab., IA (USA). [1987]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. (CONF-870682–7: International workshop on novel mechanisms of superconductivity, Berkeley, CA (USA), 22-26 Jun 1987). Order Number DE90016711. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The thermodynamic critical field curve has been measured for $Y_1Ba_2Cu_3O_7$ close to the superconducting transition temperature in order to determine the magnitude of the specific heat jump at the transition. The slope of the critical field curve is found to be 165 Oe/K, which corresponds to a specific heat jump of 680 mJ/moleCuK. If the BCS theory applies, this would also imply a density of electronic states of theory applies, this would also imply a density of electronic states of 3.39 states per electron volt-unit cell and the Sommerfeld term, $\gamma = 5.3$ mJ/moleCuK^2. 7 refs., 4 figs.

48922 (IS-M–641) **Microfilamentary $Bi_2Sr_2Ca_1Cu_2O_8$ fibers.** Miller, T.A. (Ames Lab., IA (USA)); Sanders, S.C.; Finnemore, D.K.; LeBeau, S.E.; Righi, J. Ames Lab., IA (USA). [1990]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. (CONF-900133–3: International conference on superconductivity, Bangalore (India), 10-14 Jan 1990). Order Number DE90018013. Source: NTIS, PC A02/MF A01 - OSTI.

Techniques have been developed for the fabrication of superconducting microfilaments of $Bi_2Sr_2Ca_1CU_2O_8$ as part of a larger project to produce microfilamentary composites. The process is based on a gas jet fiberization of a viscous liquid melt to form long slender amorphous fibers. A subsequent anneal then converts the fibers to the superconducting crystalline phase. Fiber diameters range from 1 to 6μm and length to diameter ratios range between $10^3$and 10^4 so the dimensions are favorable for composite formation. The details of grain growth are reviewed with special emphasis on the role of the filament diameter on the morphology of the grain growth. 4 refs., 7 figs.

48923 (IS-M–642) **μ^+SR studies on $Sr_2CuO_2Cl_2$, La_2CuO_4, and Nd_2CuO_4: 2-d magnetism, local fields and muon sites.** Le, L.P. (Columbia Univ., New York, NY (USA). Dept. of Physics); Luke, G.M.; Sternlieb, B.J.; Uemura, Y.J.; Brewer, J.H.; Riseman, T.M.; Johnston, D.C.; Miller, L.L.; Hidaka, Y.; Murakami, H. Ames Lab., IA (USA). [1990]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. (CONF-900489–3: 5. international conference on muon spin rotation, relaxation and resonance, Oxford (UK), 9-12 Apr 1990). Order Number DE90018014. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We compare the temperature dependence of the zero-field muon spin precession frequency observed in $Sr_2CuO_2Cl_2$ and La_2CuO_4 below the Neel temperature with a 2-d Heisenberg model with an additional small anisotropy. Good agreement of the observed results with this model reflects the highly 2 dimensional magnetic properties of these cuprates. The measured local fields are compared with a simple calculation of dipolar fields in the crystal to search for muon site locations. Our results provide evidence that the muon sites are to the oxygen atoms in these compounds. 7 refs., 5 figs.

48924 (IS-T–1489) **Processing of $YBA_2Cu_3O_7$ tapes from a molten salt precursor.** Millis, R.P. Ames Lab., IA (USA). 10 Sep 1990. 89p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE90017656. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

A novel process for forming a viscous nitrate precursor of the superconducting $YBa_2Cu_3O_{7-x}$ material, without the use of binders or plasticizers, is described. The precursor material is formed at 90°C from low melting salts such as $Ba(OH)_2{\cdot}8H_2O$, $Cu(NO_3)_2{\cdot}3H_2O$ and an aqueous nitrate solution of yttrium. The viscous precursor behaves as a concentrated suspension, being composed of particles of $Ba(NO_3)_2$ and $Cu_2(OH)_3(NO_3)$ which are "bound" together by a gelatinous yttrium nitrate phase. This material has shown desirable properties for the formation of thin tapes through the doctor blade tape casting process. A technique is described for forming thin sheets of superconducting $YBa_2Cu_3O_{7-x}$ by tape casting a viscous molten salt precursor which shows desirable rheological properties without the addition of binders or plasticizers. The drying of these tapes has shown the formation of a yttrium nitrate binder phase to be important in reducing cracking. The firing of these tapes has shown that the metal nitrates in the dried material decompose individually when heated in an oxygen atmosphere and react to form the superconducting phase above 750°C. The decomposition of the nitrates has resulted in extensive

porosity in the fired tapes. The superconducting phase was formed in a single heat treatment and oxygen anneal. Magnetometer measurements have shown a transition temperature of T_c= 88K at 10% of 50 Oe field cooled saturation value.

48925 (ITF–88-127) **Bose-condensation in limited two-dimensional systems and the critical temperatures of superconducting ceramics.** Fomin, P.I. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1988. 9p. (In Russian). Order Number DE91601677. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The formulas describing the Bose-condensation in limited two-dimensional systems are obtained. The Bose-condensation temperature T_B is logarithmically dependent on the size of a system. The critical temperatures T_C of superconducting ceramics are treated by identifying T_C with the temperature T_B of two-dimensional Bose-condensation of paired carriers in metal-oxide layers limited by the size of granules (or the size of twins in the presence of twinning). The estimated T_B at the values of the parameters characteristic of high-temperature superconducting ceramics are close to the observed T_C. 9 refs.

48926 (KFTI–88-38) **Study on the fracturing of cermets in the tungsten monocarbide-cobalt system during microimpact loading.** Kovalenko, V.I.; Marinin, V.G. AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst. 1988. 10p. (In Russian). Order Number DE91601671. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Results of studying the values and character of fracturing of cermets depending on cobalt content and the size of tungsten carbide particle during microimpact loading are presented. Investigations are carried out at installation with ultrasound cavitation produced in water by a vibrator with oscillation amplitude of $30x10^{-6}$ m and the frequency of 21 kHz. It is stated that under cavitation effect the dependence of alloy resistence on cobalt content in them is similar to dependence of other stability characteristics of these alloys on cobalt content. It is shown that in low-cobalt alloys (VK6) the alloy resistance decreases with increase of tungsten carbide particles from 1.0 to 2.4 μm. Therewith correlation of cavitation resistance of alloys with their resistance to abrasive wear is observed. In high-cobalt alloys (VK6) this dependence of resistance on the size of tungsten carbide particles is of a more complex character. The obtained results testify to the fact that fracturing of cermets to a great extent is defined by properties of alloy cobalt phase. 18 refs.; 6 figs.; 2 tabs.

48927 (LBL–26455, pp. 218) **Nonlinear pressure dependence of T_c in single-crystal superconducting BiCaSrCuO.** Goldstein, H.F.; Bourne, L.C.; Yu, P.Y.; Zettl, A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

In a previous work, the pressure dependence of T_c in ceramic LaSrCuO superconductors was found to be highly nonlinear. The polycrystalline nature of these materials made it difficult to interpret the non-linear pressure dependence. It has now been shown that, even in single-crystal BiCaSrCuO compounds, a similar nonlinear dependence exists and, furthermore, the pressure dependence is reproducible on increasing and decreasing pressure cycles. None of the existing theories on superconductivity can explain this nonlinear pressure dependence satisfactorily.

48928 (LBL–26455, pp. 219) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The temperature and pressure dependence of electrical resistance in high-quality single crystals of Cu_2O have been studied under pressures exceeding 0.5 Mbar. The resistance of Cu_2O dropped by several orders of magnitude around 100 kbar. The temperature dependence of the resistance suggested that Cu_2O had transformed into a semimetallic state. Above 300 kbar the temperature dependence suggested a metallic state that is not superconducting at temperatures down to 4.2 K. Single crystals of CuO have been grown at Berkeley and obtained from France. These single crystals have been characterized by polarized Raman scattering for the first time, and their electrical resistance has been studied as a function of temperature and pressure. The activated resistance characteristic of a semiconductor has been observed up to pressures as high as 700 kbar. However, the activation energy of the resistivity decreased monotonically with pressure. Extrapolating from these results, CuO is expected to become metallic above 1 Mbar. Some other projects that should yield interesting results include novel properties of semiconductor superlattices under pressure, the study of laser-induced melting and synthesis under high pressure, and studies of dynamics of glasses under high pressure.

48929 (LBL–26455, pp. 221) **TEM characterization of nanocrystals produced by decomposition reactions.** Dahmen, U.; Westmacott, K.H. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Nanocrystalline particles and structures are by definition ideal subjects for study by transmission electron microscopy. By the combined use of high-resolution, high-voltage in situ and microanalytical electron microscopy, direct information on crystalline structures and morphologies and their orientation relationships and interactions can be obtained. In the present work, metal oxide nanocrystals are produced by thermal decomposition of Mg and Al hydroxide crystals or powders. Decomposition is observed during either in situ heating or electron irradiation. High-resolution studies show that the resulting structures consist of fine dispersions of nanocrystallites slightly misoriented with respect to each other. Since the decomposition produces large areas of clean internal surface, consolidation of these materials should in principle yield high-purity, high-density oxides. To explore the potential for such processing, the effects of variables such as the initial form, source, and purity of the hydroxides on the final microstructure is being studied. Preliminary results comparing the microstructures derived from single crystals and powders produced by commercial and spark erosion methods were obtained.

48930 (LBL–26455, pp. 224) **Fluctuations and high-T_c superconductivity.** Thompson, R.S.; Kresin, V.Z. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The leading correction due to thermodynamic fluctuations to the dependence of the heat capacity on temperature and applied magnetic field is calculated for anisotropic high-T_c superconductors. Experimental data are discussed.

48931 (LBL–26455, pp. 225) **Materials for enhanced heavy fuel capability marine diesels.** Levy, A.V. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The application of thin, 0.1 mm thick partially stabilized Y_2O_3 and CeO-ZrO_2 plasma sprayed ceramic coatings on the piston domes and exhaust manifolds of several test diesel engines has been completed. The engines propel large, off-the-road ore hauling trucks at an open pit copper mine. The modified engines will be installed in the trucks for an approximately two year test period, at the end of which the ceramic coated parts will be destructively analyzed.

48932 (LBL–27358) **In-situ transmission electron microscopy and computer simulation study of the kinetics of oxygen loss in $YBa_2Cu_3O_z$.** Burmester, C.P. (Lawrence Berkeley Lab., CA (USA)); Gronsky, R.; Wille, L.T.; Ahn, B.T.; Lee, V.Y.; Beyers, R.; Guer, T.M.; Huggins, R.A. Lawrence Berkeley Lab., CA (USA). Jul 1990. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-901105–2: Fall meeting of the Materials Research Society, Boston, MA (USA), 26 Nov - 1 dec 1990). Order Number DE90014508. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

High resolution transmission electron microscopy during in-situ quenching of $YBa_2Cu_3O_z$ is used to study the kinetics of microdomain formation during oxygen loss in this system. Image simulations based on atomic models of oxygen-vacancy order in the basal plane of this material generated by Monte Carlo calculations are used to interpret high resolution micrographs of the

structures obtained by quenching. The observed domain structures agree well with those obtained from the simualtions. 9 refs., 6 figs.

48933 (ORNL/FTR–3713) **[Mechanical behavior of ceramics and composites]: Foreign trip report, August 2, 1990–August 22, 1990.** Rowcliffe, A.F. Oak Ridge National Lab., TN (USA). 4 Sep 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90017311. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The visit was made while the traveler was on vacation in Europe. The ceramic programs in the Royal Institute of Technology represent a new initiative in the area of processing and mechanical behavior of ceramics and composite materials. This venture is still growing in terms of equipment and personnel and is currently funded at ~$1.0M/year. Several projects are related to a new investigation at ORNL to assess the radiation performance of composite materials and their possible application in fusion energy systems. Theoretical and experimental investigations of fiber-toughening mechanisms were reviewed, including the application of nanoindentation techniques. The stability of Nicalon fibers was discussed, and sources of alternative SiC fibers from European manufacturers identified.

48934 (PB–90-251448/XAB) **Preparation and structural characterization of Tl-Sr-Ca-Cu-O superconducting materials.** Kamo, T.; Takeuchi, S. Hitachi Ltd., Tokyo (Japan). ©Feb 1990. 9p. Source: NTIS, PC A05/MF A01.

Included in Hitachi Review, Vol. 39, No. 1, 47-54(Feb 1990).

It was found that the Tl-Sr-Ca-Cu-O (TSCC) system gives rise to at least two superconducting phases, a high-T(c) phase of 101 K and a low-T(c) phase of about 75 K. The crystal structure of these two phases, which are isostructural to those of the Tl-Ba-Ca-Cu-O (TBCC) and Bi-Sr-Ca-Cu-O (BSCC) systems, were assigned a 3-layered (c=12.10 A, a=b=3.785 A) and 4-layered (c=15.27 A, a=b=3.809 A) perovskite structure with a single Tl-O sheet, respectively, by Rietvelt refinement of XRD patterns. The Tl-Ba/Sr-Ca-Cu-O (TBSCC) system, which was the solid solution between TBCC and TSCC, was obtained with a much higher volume fraction of high-T(c) phase than the TSCC and TBCC systems. Comparing the T(c)s and crystal structures of the Tl and Bi systems, it was suggested that the T(c) is mainly ruled by the combination of two alkaline earth elements, i.e., Sr/Ca or Ba/Ca, when the number of layered perovskites is the same.

48935 (PB–90-251455/XAB) **Development of high-Tc superconducting wire with high critical current density.** Matsumoto, T.; Aihara, K.; Seido, M. Hitachi Ltd., Tokyo (Japan). ©Feb 1990. 9p. Source: NTIS, PC A05/MF A01.

Included in Hitachi Review, Vol. 39, No. 1, 55-62(Feb 1990).

The discovery of superconductors with a critical temperature T(c) higher than the temperature of liquid nitrogen (77 K), following the discovery of the high-T(c) superconductor in 1986, has stimulated the development of superconducting equipment operated with liquid nitrogen cooling. It is necessary to develop a high-T(c) superconducting wire with high critical current density for power applications such as superconducting magnets. A silver sheathed superconducting tape has been developed using a special fabrication process. The critical current density J(c) has reached 3300 A/sq cm and 10,000 A/sq cm at 77 K without an external magnetic field, for the tapes with Y-Ba-Cu-O and Tl-Ba/Sr-Ca-Cu-O superconducting cores respectively. The J(c)s in a magnetic field, however, are considerably lower.

48936 **Thermal and laser assisted conversion of metallo-organic precursors to ceramic materials.** Brown, G.M. (Oak Ridge National Laboratory, TN (USA)); Maya, L. pp. 35, Paper INOR 118 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). DOE Contract AC05-84OR21400. (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

Vacuum pyrolysis of the ammonolysis product of titanium tetrakis(dimethylamide) produces TiN as a powder. The reaction pathway can be altered by carrying the reaction out in a stream of hydrogen, and this pathway allows the conversion of the precursor to TiN to occur at a lower temperature. The polymer is soluble in organic solvents when the group R is 2-ethylhexyl, and films of the precursor can be obtained by spin coating. The thermal conversion of this alkyl imide polymer to TiN was studied by temperature programmed pyrolysis, and the reaction of thin films of the precursor on a transparent substrate was studied by infrared spectroscopy. The dynamics of laser processing of thin films of this precursor material will be discussed.

48937 **Synthesis and structure of phosphine, sulfide and amine adducts of the MO_6S_8 and W_6S_8 cluster units, molecular derivatives of Chevrel phase clusters and their tungsten analogues.** McCarley, R.E. (Iowa State Univ., Ames (USA)); Zhang, X.; Spink, D.A.; Hur, N. pp. 42, Paper INOR 140 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

This work was undertaken as part of a concerted effort to develop the molecular chemistry of the cluster units found in the Chevrel phase superconducting compounds $M_xMo_6S_8$ (M=ternary metal atoms from almost any periodic group). Our synthetic approach not only has resulted in successful preparation of $Mo_6S_8L_6$ complexes, but also the tungsten analogues $W_6S_8L_6$. Structures have been determined for all of these except $Mo_6S_8(n\text{-}PrNH_2)_6$ and $Mo_6S_8(py)_6$. Structural, spectroscopic, magnetic and electrochemical information for the different complexes will be presented.

48938 **Low temperature organometallic chemical vapor deposition (OMCVD) of rhodium and iridium thin films.** Smith, D.C. (Los Alamos National Laboratory, NM (USA)); Sattelberger, A.P.; Pattillo, S.G.; Elliott, N.E.; Laia, J.R. pp. 44, Paper INOR 148 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

The authors will describe new low temperature ($\leq$ 300°C) routes to rhodium and iridium thin films from volatile organometallic precursors that have been developed at Los Alamos. The following topics will be discussed: (1) synthesis and characterization of the organometallic precursors, (2) the conditions of film growth and the types of substrates used, (3) experimental variables (e.g., pressure, substrate temperature hydrogen concentration, etc.) and their effect on film quality and film deposition rates, and (4) experimental characterization of the metal films by X-ray diffraction, scanning electron microscopy, and Auger spectroscopy.

48939 **X-ray photoelectron studies of thorium oxide and thorium oxide hydrate.** Perry, D.L. (Univ. of California, Berkeley (USA)). pp. 88, Paper INOR 305 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

X-ray photoelectron spectral studies have been conducted on thorium(IV) oxide, ThO_2, the only stable oxide of thorium, and its hydrated form. The thorium $4f_{7/2,5/2}$ and oxygen 1s photoelectron lines were studied with respect to their binding energies, peak width (FWHM), and associated satellite structure. Spin-orbit splittings have been recorded for the different species, and the splittings have been compared to those of other 4f line systems such as those observed for uranium and lead. The satellite structure is discussed in terms of charge transfer mechanisms related to the thorium-oxygen donor set of ligand atoms.

48940 **Readout techniques and radiation damage of undoped cesium iodide.** Woody, C.L. (Brookhaven National Lab., Upton, NY (USA)); Levy, P.W.; Kierstead, J.A.; Skwarnicki, T.; Sobolewski, Z.; Goldberg, M.; Horwitz, N.; Souder, P.; Anderson, D.F. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA)*, 37(2): 492-499 (Apr 1990). DOE Contract AC02-76CH00016. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

Several readout techniques for undoped CsI have been studied which utilize the fast scintillation component for speed, and the high photon yield for good energy resolution. Quantum yields have

been measured for samples up to 30 cm in length using photomultiplier tubes, wavelength shifters, and silicon photodiodes. A study has also been made of the scintillation properties of undoped CsI. It is found that the light output and decay time of the 310 nm fast component increases and the emission spectrum shifts to longer wavelengths at lower temperatures. The effects on the optical transmission and scintillation light output due to radiation damage from ^{60}Co gamma-rays has been measured for doses up to $\sim 10^6$ rad. It is found that the radiation resistance of undoped CsI is substantially higher than has been reported for thallium doped CsI.

48941 Optical and mechanical properties of hot-pressed cesium iodide. Kim, H.E. (Oak Ridge National Lab., TN (USA). Metals and Ceramics Div.); Moorhead, A.J. *Journal of the American Ceramic Society (USA),* 73(3): 496-501 (Mar 1990). DOE Contract AC05-84OR21400.

This paper reports on polycrystalline CsI disks fabricated by hot-pressing in a nitrogen-purged glove box. Densification during hot-pressing occurred by plastic flow resulting from lattice dislocation glide. Primary recrystallization and extensive grain growth were observed. Both the optical and mechanical properties of this material were significantly affected by grain growth, but in opposite ways. Transmittance increased and strength decreased as grain size increased. The hot-pressed CsI had transmittance of about 85% in the extra-long-wavelength infrared range, a value equivalent to that of single-crystal CsI. The flexural strengths of the CsI that was hot-pressed under conditions that minimized grain growth was about 8 times higher than that of single-crytal CsI.

48942 Fracture resistance behavior of silicon carbide whisker-reinforced alumina composites with different porosities. Krause, R.F. (National Inst. of Standards and Technology, Gaithersburg, MD (USA)); Fuller, E.R.; Rhodes, J.F. *Journal of the American Ceramic Society (USA),* 73(3): 559-566 (Mar 1990).

Fracture resistance behavior was characterized for SiC-whisker-reinforced alumina composites with porosities ranging from 0.6% to 11.5%. The composites were hot-pressed from an Al_2O_3 powder with 25 wt% SiC whiskers. Strengths of individual specimens were measured in four-point flexure either for natural flaws or for Vickers-indentation flaws as a function of radial crack size. Indentation crack sizes were controlled with indentation loads which varied between 2 and 200 N. A method of analysis of these measurements indicates that the fracture resistance of these composites increases as a function of crack extension, a rising *R* curve. This behavior is interpreted in terms of tractions from both crack-bridging whiskers and interlocking grains, which develop in the wake of the crack tip as it extends.

48943 Bonding mechanisms in silicon nitride brazing. Loehman, R.E. (Sandia National Labs., Albuquerque, NM (USA)); Tomsia, A.P.; Pask, J.A.; Johnson, S.M. *Journal of the American Ceramic Society (USA),* 73(3): 552-558 (Mar 1990). DOE Contract AC04-76DP00789.

The authors have investigated the wetting behavior and reactions of different metals on Si_3N_4 using sessile drop measurements, analysis of reaction layers, and measurements of strengths of joined bars. Active metals, such as Al and Ti, and alloys that contain them react with Si_3N_4 and cause wetting and spreading at the interface. Al-Si_3N_4 reaction at 900° produced a thin layer of Al_2O_3 at the interface. Reaction between Si_3N_4 and Ag-Cu-Ti braze alloys at 900°C resulted in a complex microstructure in the reaction zone that contained TiN and titanium silicides.

48944 Effect of hydrogen-water atmospheres on corrosion and flexural strength of sintered α-silicon carbide. Kim, H.E. (Oak Ridge National Lab., TN (USA). Metals and Ceramics Div.); Moorhead, A.J. *Journal of the American Ceramic Society (USA),* 73(3): 694-699 (Mar 1990). DOE Contract AC05-84OR21400.

This paper reports sintered α-SiC exposed for 10 h to H_2 containing various partial pressures of H_2O (P_{H_2O} from 5×10^{-6} to 2×10^{-2} atm; 1 atm $\approx 10^5$ Pa) at 1300° and 1400°C. Weight loss, surface morphology, and room-temperature flexural strength were strongly dependent on P_{H_2O}. The strength of the SiC was not significantly affected by exposure to dry H_2 at a P_{H_2O} of 5×10^{-6} atm; and following exposure at $P_{H_2O} > 5 \times 10^{-3}$ atm, the strength was even higher than that of the as-received material. The increase in strength is thought to be the result of crack blunting associated with SiO_2 formation at crack tips. However, after exposure in an intermediate range of water vapor pressures ($1 \times 10^{-5} < P_{H_2O} < 1 \times 10^{-3}$ atm), significant decreases in strength were observed.

48945 Dielectric properties of fluxed barium titanate ceramics with zirconia additions. Armstrong, T.R. (Illinois Univ., Urbana, IL (USA). Dept. of Materials Science and Engineering); Young, K.A.; Buchanan, R.C. *Journal of the American Ceramic Society (USA),* 73(3): 700-706 (Mar 1990).

$BaTiO_3$ compacts, when fluxed with < 2 vol% of a complex borate glass phase, were sintered to near theoretical density at temperatures < 1175°C in 2 h. Microstructural analysis showed a uniform grain size < 1.0 μm with 0.75 wt% ZrO_2 added to the flux phase as a grain growth inhibitor. TEM analysis revealed a microcrystalline grain-boundary phase with the ZrO_2 resident along the grain boundaries. These samples displayed an essentially flat dielectric profile, low dissipation factors (< 2%) over the range 25° to 125°C, a near linear dependence (≈ ± 15%) between 25° and −55°C, and significantly increased voltage stability. X-ray diffraction analysis of these small-grained materials indicates a suppression of the tetragonal structure toward a more cubic modification.

48946 Raman spectra of molybdenum phosphate glasses and some crystalline analogues. Morgan, S.H. (Fisk Univ., Nashville, TN (USA). Dept. of Physics); Magruder, R.H. *Journal of the American Ceramic Society (USA),* 73(3): 753-756 (Mar 1990).

The Raman spectra of a series of glasses in the system $MoO_3P_2O_5$ and the polycrystalline compounds molybdenum metaphosphate ($MoO_2(PO_3)_2$) and molybdenum pyrophosphate ($(MoO_2)_2P_2O_7$) are reported. The spectra indicate that traces of P=O and phosphate chains are present only in glasses having less than 50 mol% MoO_3. Comparison of the glass spectra with spectra of crystalline molybdenum phosphates indicates the presence of metaphosphate and orthophosphate structural groups of MoO_3 concentrations of about 50 mol% or less. As the MoO_3 concentration is increased, the bands characteristic of pyrophosphate groups appear in the spectra and become the dominant feature at 76 mol% MoO_3 concentration.

48947 Formation and pore structure of boron nitride aerogels. Lindquist, D.H. (Dept. of Chemistry and Chemical Engineering, Univ. of New Mexico, Alberquerque, NM (US)); Borek, T.T.; Kramer, S.J.; Kramer, S.J.; Naruta, C.K.; Johnson, G.; Schaeffer, R.; Smith, D.M.; Paine, R.T. *Journal of the American Ceramic Society (USA),* 73(3): 751-760 (Mar 1990).

This paper reports gels containing a poly(borazinyl amine) and tetrahydrofuran processed by CO_2 supercritical drying techniques followed by pyrolysis. The resulting BN ceramic aerogels are highly porous, and the microstructure, porosity, and surface area characteristics have been examined. The aerogels show excellent thermal stability exhibiting surface areas in excess of 350 m^2/g and porosities greater than 0.8 even when heated in argon at 1500°C for 8 h. By removing solvent via evaporation before supercritical drying, the mean pore radius can be varied between 3.6 and 10 nm.

3606 Other Materials

Refer also to citation(s) 48094, 48274, 48461, 48462, 48463, 48464, 48600, 48646, 48674, 48840, 48855, 48863, 48876, 48887, 48908, 48912, 48933, 48942, 49035, 49073, 49074, 49078, 49079, 49104, 49106, 49110, 49113, 49151, 49153, 49217, 49400, 49405, 49738, 49892, 50085, 50233

48948 (AD-A-222882/3/XAB) **Thin-film composite materials, Phase 2. Final report, 1 April-31 December 1986.** Chittenden, D.H. San Jose State Univ., CA (USA). Jan 1987. 76p. Contract F33615-81-C-2013. Source: NTIS, PC A05/MF A01.

Prepared in cooperation with L'Garde, Inc., Tustin, CA., Rept. no. LTR-87-DC-006.

The three tasks of this program have been completed as follows: the expandable radiation system requirements were established; the expandable radiator concepts previously proposed, with extensions and some innovations, have been evaluated by preliminary

mechanical designs; and the materials evaluated were Kevlar coated with silicone, EPDM, or neoprene rubber.

48949 (CONF-900562–8) **Structure of molten salts.** Saboungi, M.L.; Howe, M.A.; Price, D.L. Argonne National Lab., IL (USA). [1990]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Spring meeting of the Electrochemical Society; Montreal (Canada); 6-11 May 1990. Order Number DE90017704. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A brief review of the structure of molten salts is given with special emphasis on structural features in reciprocal space. Selected diffraction results on halide salts containing monovalent and divalent cations are presented, along with recent results on salts containing trivalent cations. Different models and computational techniques, such as random packing of structural units, the reference interaction site model, and reverse Monte Carlo are used to derive structural information at the partial level. 15 refs., 3 figs.

48950 (CONF-900936–2) **The chemical state of iron ions implanted into silicon carbide.** HcHargue, C.J. (Oak Ridge National Lab., TN (USA)); Perez, A.; McCallum, J.C. Oak Ridge National Lab., TN (USA). [1990]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 7. international conference on ion beam modification of materials; Knoxville, TN (USA); 9-14 Sep 1990. Order Number DE90017759. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Conversion electron Moessbauer spectroscopy (CEMS) was used to determine the electron density at the nuclei and the local environment of ^{57}Fe implanted into single crystals of α-SiC at room temperature. Rutherford backscattering-ion channeling measurements showed the specimens to be amorphous (random) for all fluences studied (1, 3, 6 x 10^{16} ions/cm^2, 160 keV). The CEMS spectra were fit with a single component having a distribution of quadrupole split values, i.e., a distribution of electric field gradients. The results indicate a distribution of the implanted iron ions among several sites with slightly differing local environments.

48951 (CONF-900936–5) **Ion mixing of semiconductor superlattices.** Xia, W. (California Univ., San Diego, La Jolla, CA (USA). Dept. of Electrical and Computer Engineering); Hsu, S.N.; Han, C.C.; Pappert, S.A.; Zhu, B.; Cozzolino, C.; Yu, P.K.L.; Lau, S.S.; Poker, D.B.; White, C.W.; Schwarz, S.A. Oak Ridge National Lab., TN (USA). [1990]. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 7. international conference on ion beam modification of materials; Knoxville, TN (USA); 9-14 Sep 1990. Order Number DE90017769. Source: NTIS, PC A03/MF A01 - OSTI.

Compositional disordering of III-V compound superlattice structures has received considerable attention recently due to its potential application for photonic devices. The conventional method in induce compositional disorder is to implant a moderate dose of impurity ions (~ 10^{15} /cm^2) into the structure at room temperature, followed by a high-temperature annealing step (this process is referred to as IA here). Ion irradiation at room temperature alone does not cause any significant intermixing of layers. The subsequent high-temperature annealing step tends to restrict device processing flexibility. Ion mixing (IM) is capable of enhancing compositional disordering of layers at a rate which increases exponentially with the ion irradiation temperature. As a processing technique to planarize devices, ion mixing appears to be an attractive technology. In this work, we investigate compositional disordering in the AlGaAs/GaAs and the InGaAs/InP systems using ion mixing. We found that the ion mixing behavior of these two systems shows a thermally activated regime as well as an athermal regime, similar to that observed for metal-metal and metal-semiconductor systems. Ion mixing is observed to induce compositional disordering at significantly lower temperatures than that for the IA process. We have compared the two processes in terms of five parameters (1) irradiation temperature, (2) dose dependence (3) annealing, and (4) electrically active ions. We found that the IM process is more efficient in utilizing the defects generated by ion irradiation to cause disordering. Both the physical mechanism of ion mixing and possible device implications will be discussed. 49 refs., 6 figs.

48952 (CONF-901105–11) **Compositional imaging of semiconductor interfaces by Z-contrast scanning transmission electron microscope (STEM).** Pennycook, S.J.; Jesson, D.E.; Chisholm, M.F. Oak Ridge National Lab., TN (USA). Sep 1990. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Fall meeting of the Materials Research Society; Boston, MA (USA); 26 Nov - 1 dec 1990. Order Number DE90017763. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Conventional high-resolution electron microscopy is a coherent imaging technique best thought of as an attempt to reconstruct an image of the object by recombining the diffracted beams emerging from the sample. The image represents a coherent interference pattern and the contrast depends on the relative phases of the various diffracted beams. This pattern can take many forms since the relative phases of the beams are very sensitive to objective lens defocus and sample thickness. In certain crystal structures phase contrast images can be quite sensitive to composition, provided that the other variables are carefully controlled. The technique requires structure factor difference reflections (such as the {200} beams in the zinc blends structures) to contribute strongly to the image, and even a first order interpretation requires extensive image simulation and comparison with experiment.

48953 (CONF-901177–1) **Analysis and prediction of thermal properties of mesophases and crystals by calorimetry and supercomputers.** Wunderlich, B. (Tennessee Univ., Knoxville, TN (USA). Dept. of Chemistry). Oak Ridge National Lab., TN (USA). [1990]. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Grant DMR88-18412. From Association for the progress of new chemistry conference; Tokyo (Japan); 6-9 Nov 1990. Order Number DE90015538. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Thermal analysis as developed in the ATHAS, the Advanced THermal Analysis System, has led in the last 10 years to the description of about 150 polymers. The discussion of the entropy and the detailed study of the heat capacities has resulted in understanding of disorder and motion in many polymers, and has led to the development of theory-backed and empirical prediction schemes of the thermodynamic functions. The conformationally disordered state (condis crystalline state) was identified and shown to be different from liquid or plastic crystals. Example polymers range from the flexible polyethylene, polybutadienes, PTFE and nylons to the more rigid polyparaxylylene and aromatic polyesters and polyamides. The conformational disorder could be shown to be introduced either gradually or at a sharp transition. To get more insight, molecular dynamics simulation on supercomputers was used in cooperation with Drs. D. W. Noid and B. G. Sumpter of our institutions. At present crystals with over 6000 chain atoms can be simulated for times up to 30 ps. The crystal is normally 100 chain atoms long (crystallographic c-axis) and data were predicted for a variety of temperatures for (a) single chains, (b) chains included in one rigid ring of nearest neighbors (7 chains), and a chain surrounded by (c) one, (d) two, and (e) three mobile rings of nearest neighbors, held at constant volume by an additional rigid ring (19, 37, and 61 chains, respectively), as well as (f) without a rigid ring of chains (37 mobile chains). The computed heat capacity effect agrees with the simulation. Rotational isomers are altered by the intermolecular forces. The lifetime of defects that were proposed based on molecular mechanics calculations have been determined. 29 refs., 17 figs.

48954 (DOE/ER/45370–3) **Morphological analysis of Ionomers: Progress report, April 1, 1989–March 31, 1990.** Wisconsin Univ., Madison, WI (USA). 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER45370. Order Number DE90017611. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This report discusses the progress made during the period of April 1st, 1989 and March 31st, 1990. Topics covered are: SANS of Telechelic Ionomers, SANS of Sulfonated Polyurethanes, Effect of Matrix Polarity and Ambient Aging on the Morphology of Sulfonated Polyurethane Ionomers, Adhesive Sphere Model for Analysis of SAXS Data from Ionomers, Comparison of Structure-Property Relationships in Carboxylated and Sulfonated Polyurethane Ionomers, Development of a Liquid-like Hard Sphere

Model for Deformed Ionomer Samples, and Polymer Synthesis for Proposed Research. (JDL)

48955 (EM–92) **Canadian developments in testing concrete aggregates for alkali-aggregate reactivity.** Ontario Ministry of Transportation, Downsview, ON (Canada). Engineering Materials Office. Mar 1990. 247p. (CONF-9003203–: Canadian developments in testing concrete aggregates for alkali-aggregate reactivity, Toronto (Canada), 19 Mar 1990; MICROLOG–90-04210). Source: PC Ontario Ministry of Transportation, Engineering Materials Office, 1201 Wilson Ave., Central Bldg., Downsview, ON, CAN M3M 1J8; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A conference was held to provide a forum for presentation of Canadian research findings on methods for testing alkali-aggregate reactions in concrete aggregates. Papers were presented on topics such as mortar bar tests, distribution and composition of reaction products in existing structures and laboratory concretes, microstructural aspects, expansion testing, a modified chemical method to test siliceous carbonate aggregates, field testing of concrete, case studies of actual structures, and interlaboratory comparisons. A separate abstract has been prepared for one paper from this conference.

48956 (IS-M–635) **A study of the thermoelectric properties of Ca, Sr and Hg substituted lanthanum sulfides.** Nakahara, J.F. (Ames Lab., IA (USA)); Tschetter, M.J.; Beaudry, B.J.; Takeshita, T.; Gschneidner, K.A. Jr. Ames Lab., IA (USA). [1987]. 17p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-7405-ENG-82. (CONF-8709426–1: 1. European conference on thermoelectrics, Cardiff (UK), 15-17 Sep 1987). Order Number DE90016713. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Compounds of the type $La_{3-x}M_xS_4$, where M is Ca, Sr or Hg and x ranges from 0.1 to 0.9, were prepared by the pressure assisted reaction sintering (PARS) method. These compounds have the Th_3P_4-type structure. Results of the measurements of the Seebeck coefficient and electrical conductivity from room temperature to 1000°C showed these compounds to be n-type semiconductors and have electrical power factors near 11 $\mu W\ cm^{-1}\ °C^{-2}$ for $x \leq 0.3$. However, if estimates of the thermal conductivity based on the binary LaS_y series are taken into consideration, the optimum figure-of-merit shifts to higher values of x. In this study, the maximum value of the figure-of-merit was $0.4 \times 10^{-3}\ °C^{-1}$ for x = 0.6. Studies of the stability of these Th_3P_4-type ternary compounds showed the formation of a second phase at 1100°C over a period of 2000 hours. 7 refs., 7 figs., 1 tab.

48957 (IS-M–645) **Characterization of short fatigue cracks at notches in SiC particulate aluminum composite.** Biner, S.B. Ames Lab., IA (USA). [1989]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. (CONF-891024–8: The Metallurgical Society fall meeting: materials week, Indianapolis, IN (USA), 1-5 Oct 1989). Order Number DE90018043. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The initiation and growth of cracks emanating from blunt notches in 6061-Al alloy reinforced with 25% particulate SiC metal matrix composite was investigated. To elucidate the role of aging condition of the matrix on the fatigue behavior, the studies were carried out at T6 and overaged conditions. The results indicate that the initiation of fatigue cracks are insensitive to the notch severity and to the aging condition of the matrix. The overaging heat treatment resulted in slower fatigue crack growth rates. The failure of the SiC particles during the fatigue process is given as the reason for the both observed initiation and crack growth characteristics. It is also shown that the growth rate of short cracks emanating from blunt notches can be accurately described by an effective stress intensity factor range ΔK_{eff}. This could provide an adequate engineering method for design against fatigue failure from various stress concentrations for this composite system.

48958 (JINR-E–12-89-162) **Controllable changes in the porous structure of polymeric nuclear membranes.** Ovchinnikov, V.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions); Kuznetsov, V.I.; Seleznev, V.D.; Surguchev, V.V. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions. 1989. 10p. Order Number DE91601716. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Submitted to J. Membr. Sci.

It is established that the loading of the polymeric nuclear membranes by a pressure difference leads to a considerable pore growth. The dependence of the pore growth on the pressure load, initial pore radius, pore density and working surface of the sample is experimentally determined. 11 refs.; 6 figs.; 1 tab.

48959 (KFTI–88-27) **On the diffusion in metallic glasses near the vitrification temperature.** Akhiezer, I.A.; Davydov, L.N.; Spol'nik, Z.A. AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst. 1988. 5p. (In Russian). Order Number DE91601717. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Behaviour of diffusion coefficient in metallic (MG) near the vitrification temperature is analysed. It is shown that in this temperature range the diffusion coefficient growth with the temperature increase must proceed faster than according to Arrhenius law. This conclusion permits to explain observed in experiment non-arrhenius temperature dependence of diffusion coefficients in MC of small atoms. 2 refs.; 1 fig.

48960 (LBL–26455, pp. 26) **Characterization of electron-beam-induced damage structures in natural fluorite, CaF_2, by analytical electron microscopy.** Blake, D.F.; Allard, L.F.; Echer, C.J.; Freund, F. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Naturally occurring fluorite, CaF_2, develops a particular highly ordered damage structure when exposed to the primary beam in the transmission electron microscope (TEM). This structure has been variously described as ordered defect aggregates, a superlattice array of voids, and Ca colloids produced by beam-induced loss of fluorine from the fluorite structure. During a reconnaissance study of optical anisotropy in natural fluorite, the authors observed this structure under a variety of instrumental conditions. The electron-beam-induced damage structure in fluorite is described, and, based on these new data, suggestions are made of its mechanism.

48961 (LBL–26455, pp. 117-118) **Picosecond studies of the electron-hole pair dynamics in CdS_xSe_{1-x} graded semiconductors.** Harris, C.B.; Hane, J.K. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Band-edge emission characteristics of CdS_xSe_{1-x} semiconductors provide a probe of electron-hole dynamics in a system with a graded composition region. Graded semiconductors are inhomogeneous samples in which the composition varies as a function of depth. A picosecond laser system was used to create a nonequilibrium distribution of electron-hole pairs in inhomogeneous samples. Using time-correlated single-photon counting, time-resolved fluorescence measurements were performed on materials with either decreasing or increasing S concentration over a 1-2 μm region from the surface. In both cases, the decay functions reflect a simple picture of carrier diffusion into deeper regions of the sample. The dynamics of electron-hole pairs in this material may be quite different from an alloy semiconductor for which the virtual crystal approximation is valid. If the de Broglie wavelengths of the electrons and holes are short relative to the disorder, the unit cells in the disordered crystal cannot be represented by an average unit cell. In this case, the motion of carriers cannot be described in terms of an average band-gap gradient. Further studies of this CdS_xSe_{1-x} system area in progress and present an opportunity to test various models of relaxation in localized systems.

48962 (LBL–26455, pp. 138-139) **Surface bonding geometry of (2 × 1)S/Ge(001) by normal-emission angle-resolved photoemission extended fine structure.** Leung, K.T.; Terminello, L.J.; Hussain, Z.; Zhang, X.S.; Hayashi, T.; Shirley, D.A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The surface structure of (2 x 1)S/Ge(001) was determined using ARPEFS in the normal-emission direction. By comparing the experimental data with curved-wave, multiple-scattering calculations, quantitative information about the local-adsorption geometry was obtained. In particular, adsorption in a twofold bridge site, with a S-Ge bond length of 2.36 ± 0.05 Å, was found. The twofold S bridge appears most likely to occur between two partially intact symmetric Ge-Ge dimers, with the Ge dimer laterally displaced by 0.10 ± 0.05 Å from the bulk position. This result therefore provides evidence for S bonding to strong dangling bonds in the origin dimers of the clean Ge(001) surface. There is, however, no evidence of significant surface contraction or expansion in the substrate layers, in contrast to the (2 x 2)S/Ge(111) case.

48963 (LBL–26455, pp. 139-140) **Surface geometry of (1 x 1)PH_x/Ge(111) determined with angle-resolved photoemission extended fine structure.** Terminello, L.J.; Leung, K.T.; Hussain, Z.; Yayashi, T.; Zhang, X.S.; Shirley, D.A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

ARPEFS obtained from the phosphorous 1s core level was studied to determine the chemisorption geometry of (1x1)PH_x/Ge(111), prepared by partial dissociation of PH_3 adsorbed on Ge(111). The most likely composition of the adsorbate dissociation product is PH_2. The authors determined that the phosphorous adsorbs 2.26 Å above a first-layer germanium atom, and preferentially tilts toward the second-layer germanium atom with a 0.63-Å lateral displacement from a true atop position. Other geometrical parameters determined from the multiple-scattering spherical-wave analysis of the ARPEFS include the first-to-second-layer germanium Ge(1)-Ge(2) spacing (0.68 Å) and the second-to-third-layer germanium Ge(2)-Ge(3) spacing (2.68 Å). This represents a 17% contraction for Ge(1)-Ge(2) and a 9% expansion for Ge(2)-Ge(3). The importance of adsorbate scattering and how it affects data interpretation is also discussed. Comparison of this chemisorption system with other systems is made.

48964 (LBL–26455, pp. 156-157) **The preparation of planar-sheet graphite fluorides C_xF with X < 2.** Hagiwara, R.; Lerner, M.; Bartlett, N. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The chemical fluorination of second- and third-stage graphite fluoroarsenate salts with elemental fluorine in liquid anhydrous hydrogen fluoride (AHF) at ambient temperatures produces a mixture of first-stage hexafluoroarsenate, C_yAsF_6, and planar-sheet graphite fluoride, C_xF, with x as small as 1.3. X-ray powder diffraction data indicate hexagonal symmetry for $C_{1\times3}F$, with an a_0 parameter only slightly greater than that of pristine graphite. This fluoride has proved to be remarkably inert to oxidation and surfaces the oxidative attack by perchloric acid at 150°C, which destroys the C_yAsF_6. The hexagonal cell a_0 parameter is slightly greater than that of pristine graphite and in harmony with the earlier results for sp^2 carbon fluorides with x values in the range 2 to 6. The cell parameters, and the diffraction patterns from which they derive, show no relationship to those of the puckered-sheet (sp^3 carbon) carbon fluorides $(C_2F)_n$ and $(CF)_n$. The IR spectra of $C_{1\times3}F$ exhibit the most intense ν (C-F) absorption at ~ 1,125 cm^{-1} and C_2F at[1] ~ 1,100 cm^{-1}.

48965 (LBL–26455, pp. 223) **Normal and superconducting properties of new high-T_c materials.** Kresin, V.Z. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

This research is carried out in two directions: (1) analysis of normal and superconducting properties of new materials (proximity effect, normal parameters, etc.), (2) and origin of high superconducting transition temperature (T_c).

48966 (LBL–26455, pp. 209-210) **Study of the fundamental linewidths of 1S → nP donor transitions in ultrapure germanium.** Navarro, H.; Haller, E.E.; Keilmann, F. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The fundamental linewidths of dipole transitions of donor-bound electrons in ultrapure germanium were investigated. The experiments were performed on the stress-insensitive D(H,O) donor complex, which is present in concentrations of 10^{11} cm^{-3}. Various transitions (n = 2,3,4,5 and 6) were tuned with a variable magnetic field to the frequencies of several far-infrared laser lines, and the photothermal response was recorded. The transitions 1S → 2P and 1S → 3P lead to Lorentzian lines with a full width at half maximum (FWHM) of 8.2 ± 0.4 μeV. Higher excited states produce lines with a FWHM of around 6.4 μeV, the narrowest lines for electronic transition ever recorded. The experiments show that the observed linewidths do not depend on the sample temperature below 9 K, the applied electric field below 1.4 eV cm^{-1}, or band-edge light. The experimentally determined linewidths are dominated by the excited-state lifetime that results from the electron-acoustic-phonon interaction. This interaction couples the bound excited states to all the other nearby states. The excited-state lifetimes derived from the linewidths are in agreement with the values predicted by the theory of Barrie and Nishikawa.

48967 (N–90-23754) **Theory and experimental technique for nondestructive evaluation of ceramic composites.** Generazio, E.R. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1990. 18p. (NASA-TM–102561;E–5381;NAS–1.15:102561;CONF-9003201–: Meeting of the American society for nondestructive testing, Columbus, OH (USA), 15 Mar 1990). Source: NTIS, PC A03/MF A01.

The important ultrasonic scattering mechanisms for SiC and Si_3N_4 ceramic composites were identified by examining the interaction of ultrasound with individual fibers, pores, and grains. The dominant scattering mechanisms were identified as asymmetric refractive scattering due to porosity gradients in the matrix material, and symmetric diffractive scattering at the fiber-to-matrix interface and at individual pores. The effect of the ultrasonic reflection coefficient and surface roughness in the ultrasonic evaluation was highlighted. A new nonintrusive ultrasonic evaluation technique, angular power spectrum scanning (APSS), was presented that is sensitive to microstructural variations in composites. Preliminary results indicate that APSS will yield information on the composite microstructure that is not available by any other nondestructive technique.

48968 (N–90-24350, pp. 13-18) **Dynamic mechanical analysis of polymeric materials.** Kern, K.T. (Old Dominion Univ., Norfolk, VA (USA)); Harries, W.L.; Long, S.A.T. National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center. May 1990. (NASA-CP–3074;L–16785;NAS–1.55:3074;CONF-8910299–: National Educators workshop, Norfolk, VA (USA), 17-19 Oct 1989). In *National Educators' workshop: Update 1989 standard experiments in engineering materials science and technology.* Source: NTIS, PC A09/MF A02.

Polymeric materials exhibit mechanical behavior which is dependent on temperature. Dynamic mechanical analysis measures the mechanical damping and resonant frequency of a material over a temperature range. Values of the dynamic loss modulus, storage modulus, and loss tangent can be calculated from these data. The glass transition temperature and onset temperature are obtained from curves of the dynamic moduli versus temperature.

48969 (N–90-24382) **Influence of interfacial shear strength on the mechanical properties of SiC fiber reinforced reaction-bonded silicon nitride matrix composites.** Bhatt, R.T. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1990. 14p. (NASA-TM–102462;E–5250;NAS–1.15:102462;AVSCOM-TR–90-C-003;CONF-9002 International symposium on interfacial reactions in metal or ceramics matrix composites, Anaheim, CA (USA), 19-22 Feb 1990). Source: NTIS, PC A03/MF A01.

The influence of fiber/matrix interface microstructure and interfacial shear strength on the mechanical properties of a fiber-reinforced ceramic composite was evaluated. The composite consisted of approximately 30 vol percent uniaxially aligned 142 microns diameter SiC fibers (Textron SCS-6) in a reaction-bonded

Si_3N_4 matrix (SiC/RBSN). The interface microstructure was varied by controlling the composite fabrication conditions and by heat treating the composite in an oxidizing environment. Interfacial shear strength was determined by the matrix crack spacing method. The results of microstructural examination indicate that the carbon-rich coating provided with the as-produced SiC fibers was stable in composites fabricated at 1200 C in a nitrogen or in a nitrogen plus 4 percent hydrogen mixture for 40 hr. However this coating degraded in composites fabricated at 1350 C in N2 + 4 percent H2 for 40 and 72 hr and also in composites heat treated in an oxidizing environment at 600 C for 100 hr after fabrication at 1200 C in a nitrogen. It was determined that degradation occurred by carbon removal which in turn had a strong influence on interfacial shear strength and other mechanical properties. Specifically, as the carbon coating was removed, the composite interfacial shear strength, primary elastic modulus, first matrix cracking stress, and ultimate tensile strength decreased, but the first matrix cracking strain remained nearly the same.

48970 (OH/RD–89-261-K) **A statistical comparison of uplift design methods for augered footings in sand.** Cragg, C.B.H.; Tsang, R.H.K. Ontario Hydro, Toronto, ON (Canada). Research Div. 17 Nov 1989. 42p. (MICROLOG–90-03525). Source: PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

Several methods for estimating the uplift capacity of augered footings in sand are evaluated. Using a data base of 217 load tests and a robust statistical approach, the accuracy of 8 methods for predicting uplift capacity are compared and ranked. The current formulations of the cylindrical shear model provide more accurate and reliable predictions than the truncated cone or the curve shear surface model. No single theory provides the most accurate predictions in the 3 density ranges (loose, compact and dense). A combination of theories provides improved forecasting accuracy over the use of a single theory. The use of Ko (the 'at rest' case of the lateral earth pressure coefficient) for loose soil in combination with Ku (the ubiquitous empirical uplift coefficient) for compact and dense soil is recommended for design work. 16 refs., 24 figs., 10 tabs.

48971 (OTO–89-022) **Effect of bacterial activity on North Sea concrete.** Khoury, G.A.; Sullivan, P.J.E. Imperial Coll. of Science and Technology, London (UK); Department of Energy, London (UK). Offshore Energy Technology Board. Dec 1987. 126p. Contract TA 93/22/106. Source: Available from British Library, Document Supply Centre, Boston Spa, Wetherby, West Yorks.

This research project was initiated following concern over the durability of North Sea concrete in an environment conducive to bacterial activity. Such activity may occur in North Sea oil storage tanks where growth of aerobic and anaerobic bacteria may take place in the seawater "pillow" beneath the oil thus producing acids harmful to concrete. It was decided to test the effects of the main aggressive bacterial metabolites, namely acetic and sulphuric acids mixed with seawater, on typical North Sea concrete for periods ranging from 21 to 90 days. The test parameters also included temperatures of 20, 40 and 60°C, pH levels of 8, 5 and 3 and concrete pre-conditioning for 12 months at 100% RH or in seawater. The main series of tests included mechanical, microstructural and chemical investigations. The mechanical tests comprised compressive strength measurements of concrete specimens, weight loss measurements of cement paste specimens, and in-situ length change measurements of mortar bar specimens. (author).

48972 (PNL-SA–17678) **Theoretical calculations of the nonlinear dielectric function of inhomogeneous thin films.** Risser, S.M.; Ferris, K.F. Pacific Northwest Lab., Richland, WA (USA). Aug 1990. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-900466–83: Spring meeting of the Materials Research Society, San Francisco, CA (USA), 16-21 Apr 1990). Order Number DE90017645. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The optical response of thin dielectric films can be influenced by grain morphology and the presence and distribution of defects. In the limit of random defects and small electric field amplitudes, approximate methods exist to model the real part of the dielectric constant in terms of volume fractions and bulk dielectric constants of the film components. Explicit inclusion of nonlinear polarizabilities and details of the microstructure, such as particle phase, shape, and orientation requires a more exact approach. We have developed a method to self-consistently determine the local internal electric field and polarization in the long wavelength limit for model films with a random distributions of defects of arbitrary phase and orientation. From this we have calculated the real part of the dielectric constant as a function of nonlinear polarizability of the components, and have shown the effect of defect phase and orientation on the dielectric constant of the film. 2 refs., 4 figs.

48973 (SAND–90-0881C) **Evolution of surface area during the controlled growth of silica spheres.** Bogush, G.H. (Sandia National Labs., Albuquerque, NM (USA)); Brinker, C.J.; Majors, P.D.; Smith, D.M. Sandia National Labs., Albuquerque, NM (USA). [1990]. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900466–84: Spring meeting of the Materials Research Society, San Francisco, CA (USA), 16-21 Apr 1990). Order Number DE90017593. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Several mechanisms have been proposed for the growth of silica spheres by the controlled hydrolysis of silicon alkoxides, the limiting cases of which are the conventional and aggregative growth models. The evolution of surface area predicted from the two models is substantially different at early times into the reaction. In order to probe the change in surface area during growth, ^1H NMR measurements of the solvent were made during the growth process. It has been demonstrated that the spin-spin relaxation time (T_2) for an absorbed phase is less than that of the bulk solvent. Using this principle, the change in surface area can be followed in situ during the reaction. The experimental results were compared to the predictions of the conventional model and found not to be in agreement. 6 refs., 3 figs.

48974 (SAND–90-1718C) **Electric-field dependent electroreflectance and photocurrent spectroscopy in InGaAs/InAlAs strained-layer superlattices.** Fritz, I.J.; Klem, J.F.; Brennan, T.M.; Wendt, J.R.; Zipperian, T.E. Sandia National Labs., Albuquerque, NM (USA). [1990]. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901105–4: Fall meeting of the Materials Research Society, Boston, MA (USA), 26 Nov - 1 dec 1990). Order Number DE90015698. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Strained-layer epitaxy provides unique flexibility in tailoring the physical properties of compound semiconductor quantum-well structures. For example, without constraints on lattice matching it is possible to vary bandgap by varying alloy composition in many material systems. Currently, InGaAs alloys are receiving much attention because their bandgaps span the near-infrared wavelength range of interest for optical communication. Sanders and Chang and Hong, et. al., have shown that superimposed HH and LH bandgaps lead to enhanced optical absorption at the bandgap due to (1) the addition of the two oscillator strengths and (2) an increase in the density of states due to the modified valence-band dispersion. These effects may enhance the performance of optoelectronic devices. In the following we consider the design of InGaAs/InAlAs strained quantum-well structures with wells in biaxial tension and bandgap energies near 0.80 eV (1.55 μm wavelength). We present first some model calculations and then data on two-strained layer superlattice (SLS) structures, including results with applied electric field. 6 refs., 4 figs.

48975 (SAND–90-1755C) **Nonparabolic conduction bands and masses in strained-single-quantum wells.** Jones, E.D. (Sandia National Labs., Albuquerque, NM (USA)); Klem, J.F.; Lyo, K.; Lin, S.Y.; Tsui, D.C. Sandia National Labs., Albuquerque, NM (USA). [1990]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901105–8: Fall meeting of the Materials Research Society, Boston, MA (USA), 26 Nov - 1 dec 1990). Order Number DE90017028. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Experimental measurements of the conduction-band dispersion curves in bulk GaAs and GaAs/AlGaAs (and InGaAs/GaAs)

quantum-well structures generally have been restricted to cyclotron resonance measurements. To obtain an accurate conduction-band E vs. k dispersion curve using cyclotron resonance measurements, many different samples with differing carrier concentrations are required. The various parameters to the band structure then have been obtained by fitting a k·p calculation to the data. The breaking of the usual selection rules for magneto-luminescence transitions by coulomb scattering of the carries by the dopant ions has been discussed. Theory and experiment show that higher order transitions dominate the recombination process at low temperatures, while the direct transitions dominate at higher temperatures. The temperature dependences permit a simultaneous determination both the conduction and valence-band dispersion curves and has been reported for $In_xGa_{1-x}As/GaAs$ strained-single-quantum well (SSQW) structures. In this paper, we present the results of the measurements the conduction-band energy dispersion curve (and nonparabolic conduction-band mass) obtained from magneto-luminescence measurement on a single $In_{0.25}Ga_{0.75}As/GaAs$ 80 Å n-type SSQW structure. Also presented are the results of the measurement, on the same sample, of the conduction-band mass using far-infrared cyclotron resonance techniques. 14 refs., 3 figs.

48976 (SAND–90-1756C) **Photoluminescence studies of $In_xGa_{1-x}As/Al_yGa_{1-y}As$ strained-layer structures: Effects of annealing.** Jones, E.D.; Dawson, L.R.; Klem, J.F.; Myers, D.R.; Wendt, J.R.; Zipperian, T.E. Sandia National Labs., Albuquerque, NM (USA). [1990]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901105–9: Fall meeting of the Materials Research Society, Boston, MA (USA), 26 Nov - 1 dec 1990). Order Number DE90017031. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Photoluminescence measurement techniques are a valuable tool in determining the "purity" of semiconductor materials. In this paper, we present low-temperature photoluminescence measurements to demonstrate the effects due to rapid-thermal anneals (RTA) on three different $In_xGa_{1-x}As/Al_yGa_{1-y}As$ strained-single-quantum well (SSQW) structures. Two of the structures are unintentionally doped and the other is a beryllium doped, p-type structure. One of the unintentionally doped structures provides an example of strain metastability and the effects of annealing. The remaining structures provide examples of where the RTA had little effect, but other changes in the luminescence spectra are noted. 12 refs., 3 figs.

48977 (SAND–90-2153C) **Implementation of a QML (Qualified Manufacturer's List) methodology for discrete semiconductors.** Halbleib, L.L. (Sandia National Labs., Albuquerque, NM (USA)); Wormington, P.S.; Lumpe, S.W.; Dwyer, J.P. Sandia National Labs., Albuquerque, NM (USA). [1990]. 3p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901124–1: Government microcircuit applications conference: technology strategies for the 90's, Las Vegas, NV (USA), 6-8 Nov 1990). Order Number DE90015715. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Agencies that are prime contractors to the Department of Energy (DOE) have developed and are currently instituting a quality initiative which applies a QML-like methodology to a complete discrete semiconductor process. Our goal is to demonstrate that improving the quality of this process is a more efficient method than screening to improve the quality of the semiconductor. The QML methodology, MIL-I-38535, is used to achieve this goal for integrated circuits. Our methods, for discrete semiconductor, applies many of the principles found in this specification to provide structured continuous improvement. Improvement in product performance reduces incoming inspection requirements, resulting in reduced cost and product lead time. This paper describes our methodology for this initiative, which consists of a certification, qualification, and monitoring (CQM) program for the complete semiconductor process. This process includes all technical and administrative activities that effect the quality of a device, beginning with circuit design and ending with the installation of the manufactured device into the electronic component assembly. For the initial application, our CQM program is being implemented on a small signal transistor. Four companies are involved in the partnership: Sandia National Laboratories, a design agency and prime contractor to the DOE; Allied-Signal Aerospace Company, Kansas City Division, a production agency and prime contractor to the DOE (for electronic component assembly); Alliance Electronics, a prime contractor and supplier (for procurement and testing); and Motorola Inc., Semiconductor Products Sector, a manufacturer. 2 refs.

48978 (SAND–90-2191C) **Optical characterization of CdZnTe/CdTe strained quantum wells.** Reno, J.L.; Jones, E.D. Sandia National Labs., Albuquerque, NM (USA). [1990]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901105–7: Fall meeting of the Materials Research Society, Boston, MA (USA), 26 Nov - 1 dec 1990). Order Number DE90017036. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Strained layer structures have received a great deal of attention due both to their possible application in electronic devices and their intrinsic interest. The study of strained layer quantum wells grown using lattice mismatched materials has been widely developed for III-V semiconductors. Strained layer quantum wells grown using II-VI materials have not been studied nearly so much as those from III-V, but they are a rapidly growing field of semiconductor research. The wide gap II-VI materials are of interest because they are generally direct gap materials. This makes them attractive for optoelectronic devices. The majority of the work on strained layer structures in the wide gap tellurium based materials has focused in two areas. The first is the inclusion of Mn to produce dilute magnetic semiconductors (DMS) strained layers and superlattices. The other area is CdTe/ZnTe quantum wells and superlattices. Some related work has been done with CdZnTe/ZnTe structures. For the CdZnTe/CdTe very little work has been done and the majority of that used very small amounts of Zn. In this paper we will present the growth and optical characterization of $Cd_{1-x}Zn_xTe/CdTe$ strained single quantum wells (SSQW) where the Zn concentration ranges from about 10 to 50%. 10 refs., 3 figs.

48979 (SAND–90-2282C) **Stress accommodation in large-mismatch systems.** Dodson, B.W. Sandia National Labs., Albuquerque, NM (USA). [1990]. 23p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900856–1: 6. international conference on molecular beam epitaxy, La Jolla, CA (USA), 27-31 Aug 1990). Order Number DE90017032. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Accommodation of lattice mismatch is investigated for the case of large ($\epsilon > 0.02$) mismatch. The conventional Matthews-Blakeslee mechanism for creation of misfit dislocations is found to be inadequate for the case of large lattice relaxation owing to interactions amongst the misfit dislocations at the interface. In particular, the regime where the separation D between misfit dislocations is much less than the strained layer thickness h is considered here. The energetics of insertion of dense misfit dislocation networks is examined. According to St Venant's Principle, the existence of a new length scale, D, serves as a cutoff for the stress fields of the dislocation network. This observation has several consequences, including the prevention of relaxation by repulsive interaction amongst threading dislocation segments and the "melting" of moderately relaxed heterointerfaces at conventional semiconductor growth temperatures. A number of experimental observations may be explained via these models.

48980 Catalytic gated semiconductor devices as gas sensors. Hughes, R.C. (Sandia National Laboratories, Albuquerque, NM (USA)); Schubert, W.K.; Zipperian, T.E.; Rodriguez, J.L. pp. 7, Paper ANYL 21 of American Chemical Society, Division of Analytical Chemistry. American Chemical Society, Washington, DC (US) (1990). DOE Contract AC04-76DP00789. (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

Palladium gated silicon devices like tunnel diodes and MOS capacitors are sensitive room temperature hydrogen gas detectors with a wide dynamic range. Data on the performance of both diodes and capacitors fabricated at Sandia will be presented, along with a description of the mechanism which in the case of the diodes causes the effective barrier height to decrease, and in the case of the capacitors causes a negative flatband shift. For example, ethylene, H_2S and formic acid are easily detected. The catalytic activity of the gate metal can be altered by alloying the

palladium with other metals. Results on the chemical selectivity introduced by Pd/Ag alloys will be presented. For example, Cl_2 gas can be detected by Pd/Ag gates, but not by Pd gates, and NO_2 is an oxidant for H_2 on Pd/Ag, but not on Pd.

48981 Vapor hydration and subsequent leaching of transuranic-containing SRL and WV glasses. Bates, J.K. (Argonne National Lab., IL (USA)); Ebert, W.L.; Gerding, T.J. pp. 1095-1102 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper describes the results of parametric experiments where glasses were hydrated and then leached under static conditions. The purposes of the experiments were to compare the leaching of hydrated glass to that of fresh glass under simplified laboratory conditions, to provide a basis for performing long-term saturated and unsaturated testing of hydrated glass, and to develop techniques for determining the radionuclide content of secondary phases that formed during the hydration reaction. The vapor phase hydration process is described and results are presented.

48982 Recent results of the effects of gamma radiation on the durability and microstructure of DWPF glass. Bibler, N.E. (Savannah River Lab., Aiken, SC (USA)); Tosten, M.H.; Beam, D.C. pp. 1103-1109 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC09-89SR18035. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper investigates the effect of gamma radiation on the durability and microstructure of a simulated nuclear waste glass from the Savannah River. The experimental procedure is described. A statistical analysis of the results is presented.

48983 Picosecond charge-transfer events in the photosensitization of colloidal TiO_2. Kamat, P.V. (Notre Dame Radiation Laboratory, IN (USA)). *Langmuir (USA),* 6(2): 512-513 (Feb 1990).

The charge transfer from the singlet excited anthracene-9-carboxylic acid (9AC) into the conduction band of a large band gap semiconductor, TiO_2, and the recombination of injected charge with the cation radical $9AC^{\bullet+}$ have been time resolved in the picosecond-nanosecond time domain with the aid of picosecond laser flash photolysis.

48984 Sintering of spherical glass powder under a uniaxial stress. Rahaman, M.N. (Missouri Univ., Rolla, MO (USA). Dept. of Ceramic Engineering); DeJonghe, L.C. *Journal of the American Ceramic Society (USA),* 73(3): 707-712 (Mar 1990). DOE Contract AC03-76SF00098.

This paper reports the sintering of spherical borosilicate glass powder (particle size 5 to 10 μm) under a uniaxial stress studied at 800°C. The experiments allowed the measurement of the kinetics of densification and creep, the viscosities for creep and bulk deformation, and the sintering stress which was found to increase with density. The data show excellent qualitative agreement with Scherer's theory of viscous sintering. In addition, the quantitative comparison between theory and experiment shows good agreement; the measured viscosity of the bulk glass was $\sim 1 \times 10^9$ P ($\sim 1 \times 10^8$ Pa · s) compared to $\sim 3 \times 10^9$ P ($\sim 3 \times 10^8$ Pa · s) obtained by fitting the data with Scherer's theory.

48985 In-situ studies of ion irradiation effects in an electron microscope. Vetrano, J.S. (Illinois Univ., Urbana, IL (USA). Dept. of Materials Science and Engineering); Bench, M.W.; Robertson, I.M.; Kirk, M.A. *Metallurgical Transactions, A (Physical Metallurgy and Materials Science) (USA),* 20(12): 2673-2680 (Dec 1989).

This paper reports how the High-Voltage Electron Microscope (HVEM) Accelerator Facility at Argonne National Laboratory (ANL) has been used to gain insight into the process of collapse of displacement cascades to vacancy loops in metals (Ni, Cu, Fe, Ni-Si, and Ni-Al) and the crystalline-amorphous transition produced in GaAs by ion implantation.

40 CHEMISTRY

48986 (CBPF-MO–001/89) **Proceedings of 6. Latin American School on Theoretical Chemistry. v.1.** Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1988. 301p. (In Portuguese). (CONF-8809294–: 1. Rio symposium on furnace atomic absorption spectrometry, Rio de Janeiro (Brazil), 18-23 Sep 1988). Source: Available from the Library of the Comissao Nacional de Energia Nuclear, RJ, Brazil.

This book presents an overview of the invited talks given during the VI Latin American School on Theoretical Chemistry which happened in September 1988 at Rio de Janeiro. (A.C.A.S.).

48987 (PNL-SA–18212) **Upgrading user interfaces to computational chemistry codes.** Adams, K. Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 5p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-9006263–1: TAE user's conference, League City, TX (USA), 5-7 Jun 1990). Order Number DE90016560. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Researchers at Pacific Northwest Laboratory are attempting to improve the user interface to a number of computational chemistry codes. We used TAE+ to implement a new graphical user interface to one of these codes. From this task we learned that TAE+, in its current form, is not sufficient to satisfy our long term goals. We have several suggestions for improvements which will make TAE+ usable for this type of task. 4 refs., 4 figs.

4001 Analytical and Separations Chemistry

Refer also to citation(s) 48212, 48257, 48491, 48625, 48626, 48729, 48762, 48945, 48946, 49056, 49058, 49059, 49060, 49061, 49062, 49063, 49064, 49075, 49076, 49077, 49136, 49155, 49187, 49209, 49282, 49321, 49329, 49370, 49472, 49565, 49902

48988 (AD-A–223070/4/XAB) **Wear-metal analysis in engine oil by microwave digestion and atomic absorption spectroscopy. Final report, August 1987-January 1988.** Muse, W.T. Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD (USA). May 1990. 14p. (CRDEC-TR–167). Source: NTIS, PC A03/MF A01.

Digestion procedures are described for the analysis of wear metals in National Bureau of Standards (NBS) oil samples by a closed vessel microwave digestion system. Samples were analyzed by flame atomic absorption spectroscopy. Recoveries of Al, Fe, Ni, Cu, and Pb in the 300-ppm NBS oil ranged from 98 to 103% with standard deviations from 3 to 14%. This method serves as a relatively quick matrix destruction technique for the quantitation of metals in oil.

48989 (BARC–1484) **Determination of non-metallic elements in actinide complexes by oxygen flask combustion (OFC): chlorine and fluorine.** Ruikar, P.B. (Bhabha Atomic Research Centre, Bombay (India). Radiochemistry Div.); Nagar, M.S.; Subramanian, M.S. Bhabha Atomic Research Centre, Bombay (India). 1989. 19p. Order Number DE91601345. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The oxygen flask combustion followed by ion selective electrode measurement has been found to be the most suitable from the point of view of elegance and simplicity for the determination of chlorine and fluorine in actinide complexes. The method has been found to be particularly suitable for glove box adaptation. This report describes the determination of chlorine and fluorine in several uranium complexes, some plutonium complexes and organic analytical standards by this method. The precision and accuracy of the measurements in the milligram level has been found to be quite satisfactory. (author). 16 refs., 11 tabs.

48990 (CEA-CONF–9880) **Laser spectroscopy in a laser-produced plasma at atmospheric pressure: comparison between A.E.S., L.I.F., and L.E.I./R.I.S. for the analysis of solid samples.** Autin, M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (FR). Dept. de Chimie Appliquee et d'Etudes Analytiques); Briand, A.; Mauchien, P.; Mermet, J.M. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de

Chimie Appliquee et d'Etudes Analytiques. 1989. 19p. (CONF-8901206–: Winter Conference on Spectrochemistry, Reutte (Austria), 9-13 Jan 1989). Order Number DE91700550. Source: NTIS (US Sales Only), PC A03/MF A01.

The aim of this work is trace determination in solid samples by atomic spectroscopy in a laser-produced plasma at atmospheric pressure. Working directly on solid samples with laser ablation allows the micro analysis of all sorts of samples (non-conducting, biologicals...), without chemical preparation and possible pollution by chemical reagents. Working at atmospheric pressure simplifies the set-up and the samples preparation and allows a rapid method of analysis. The analytical studies of the plasma are done using Atomic Emission Spectroscopy (AES) Laser-Induced Fluorescence (LIF) and Laser Enhanced Ionization (LEI) or Resonance Ionization Spectroscopy (RIS): advantages and disadvantages of these techniques are presented.

48991 (CEA-CONF–10032) **Determination of iron 55 in nuclear wastes and effluents.** Raymond, A.; Revy, D. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI). 1989. 26p. (In French). (CONF-890617–: 2. Karlsruhe international conference on analytical chemistry in nuclear technology, Karlsruhe (Germany, F.R.), 5-9 Jun 1989). Order Number DE91700534. Source: NTIS (US Sales Only), PC A03/MF A01.

The methods for iron 55 analysis, described in this report allows measurement in different types of radioactive wastes after a specific chemical separation. Detection limit is near 1 Bq/l and the concentration factor can reach 100. Activity level found show that iron 55 is a major activation product, then the chemical determination is indispensable for a complete inventory of radionuclides in radioactive wastes.

48992 (CONF-9009174–1) **Resonance ionization spectroscopy of molecular clusters using picosecond lasers.** Miller, J.C.; Smith, D.B. Oak Ridge National Lab., TN (USA). [1990]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 5. international symposium on resonance ionization spectroscopy and its applications; Varese (Italy); 16-21 Sep 1990. Order Number DE90017334. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

High peak-power picosecond laser pulses have been used for the first time to effect nonresonant or resonant multiphoton ionization (MPI) of clusters generated in a supersonic nozzle expansion. The resultant ions are subsequently detected and characterized by time-of-flight mass spectroscopy. Specifically, we present results involving MPI of the cluster series Ar_nNO, $(NO)_n$, and Ar_nI_2. Previous MPI studies of the latter two species using nanosecond lasers have not been successful in detecting the parent ion, presumably due to fast dissociation channels. It is proposed that the present technique is a new and rather general ionization source for cluster studies which is complementary to electron impact but in addition, may provide unique spectroscopic or dynamical information. 14 refs., 5 figs.

48993 (ESTD-L–0104/R89) **Determination of boron as boric acid by automatic potentiometric titration using Gran plots [in pressurized water reactor coolant].** Midgley, D.; Gatford, C. National Power, Leatherhead (UK). Nov 1989. 19p. Order Number DE91601346. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Boron in PWR primary coolant and related waters may be determined as boric acid by titration with sodium hydroxide, using a glass electrode as a pH indicator. Earlier work has shown that this analysis can conveniently be carried out automatically with adequate precision and accuracy for routine use, although bias became apparent at the lowest concentrations tested. The latest titrators enable the titration data to be transformed mathematically to give two linear segments, before and after the end-point (Gran plots). The results are as precise as those from other titration methods (in which the end-point is found from the point of inflexion of a plot of pH against volume of titrant), but the bias at low concentrations is much reduced. This is achieved without extra time or involvement of the operator. (author).

48994 (EUR–12438) **Certification of a uranium-238 dioxide reference material for neutron dosimetry (EC nuclear reference material 501).** Pauwels, J. (Commission of the European Communities, Geel (BE). Central Bureau for Nuclear Measurements); Lievens, F.; Ingelbrecht, C. Commission of the European Communities, Luxembourg (Luxembourg). 1989. 28p. Source: NTIS (US Sales Only), PC A03/MF A01.

Uranium-238 oxide of 99.999% isotopic and 99.98% chemical purity was transformed into dioxide spheres of nominal 0.5 and 1.0 mm diameter by gel precipitation and subsequent calcination under carbon dioxide and under argon containing 5% hydrogen at 1 125 K. The spheres were analysed by thermal ionization mass spectrometry, including isotope dilution, by gravimetry and by potentiometric titration. On the basis of these analyses, the uranium mass fraction was certified at 879.4 $\pm$ 2.8 $g.kg^{-1}$, and the $^{235}U/U$ - and $^{238}U/U$ abundances at 10.4 $\pm$ 0.5 $mg.kg^{-1}$ and 999.9896 $\pm$ 0.0005 $g.kg^{-1}$, respectively. The material is intended to be used as a reference material in neutron metrology.

48995 (IS-M–618) **Modern chemical analysis of nuclear materials.** Edelson, M.C.; DeKalb, E.L. Ames Lab., IA (USA). [1989]. 11p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-7405-ENG-82. (CONF-890274–2: International symposium on near-future chemistry in nuclear energy field, Ibaraki-Ken (Japan), 15-16 Feb 1989). Order Number DE90016699. Source: NTIS, PC A03/MF A01; OSTI; INIS.

This report is a brief discussion of the modern chemical analysis technologies used in the nuclear energy research field. Methods based on inductively coupled plasma sources, resin-bead mass spectroscopy and laser analysis are discussed. (JDL)

48996 (IS-M–636) **Transient infrared emission spectroscopy.** McClelland, J.F.; Jones, R.W. Iowa State Univ. of Science and Technology, Ames, IA (USA). [1989]. 1p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. (CONF-890754–2: 6. international topical meeting on photoacoustic and photothermal phenomena, Baltimore, MD (USA), 31 Jul - 3 aug 1989). Order Number DE90017253. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Conventional infrared emission spectroscopy has normally been applied only to optically thin samples because of the phenomenon of self-absorption. In an optically thick material, self-absorption severely alters the emission so that the resulting spectrum closely resembles a black-body emission spectrum. Spectral features characteristic of the material are very weak and grossly altered in appearance, making the spectrum analytically of little use. Transient infrared emission spectroscopy (TIRES) produces useful emission spectra from optically thick samples by greatly reducing self-absorption. In TIRES a laser beam is used to rapidly heat the sample surface creating a transient hot layer. A spectrometer collects the emission from this layer before it cools and thickens by thermal diffusion. The layer is optically thin at infrared wavelengths, and so self-absorption is reduced. If a pulsed laser is used, the desired thin layer will exist at the laser spot on the sample surface for a short time immediately after the laser pulse,so the emission collection must be synchronized with the laser firing. If a continuous-wave (CW) laser is used, the sample must move through the beam or the beam must move over the sample surface. The transient layer will then exist along the beam path on the sample surface immediately behind the beam position, and thus the emission observation must be spatially correlated with the laser beam, but no synchronization is needed. Results using both types of lasers will be discussed.

48997 (JAERI-M–90-062) **Design, construction and performance tests of atomic emission spectrograph with DCA and ICP excitation systems for plutonium bearing fuels.** Fukushima, Susumu (Japan Atomic Energy Research Inst., Oarai, Ibaraki (Japan). Oarai Research Establishment); Hirata, Masaru; Handa, Muneo; Shiozawa, Ken-ichi; Mizukami, Haruo. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 57p. (In Japanese). Order Number DE90520208. Source: NTIS (US Sales Only), PC A04/MF A01.

For the determination of metallic impurity elements in plutonium bearing materials, atomic emission spectrograph with two excitation systems, direct current arc (DCA) and inductively coupled plasma

(ICP) was installed at the Plutonium Fuel Facility of Oarai Research Establishment. To use effectively the limited floor area of alpha-radioactive, experimental room and to carry out the maintenance of the spectrograph with ease, the two excitation stands were only enclosed in a glove box and that were arranged straight on one optical bench. Light generated by two stands was passed through a quartz window and into a spectrometer located outside of the glove box. This arrangement, however, posed two problems, one was the decrease of signals by increased distance between the emission stands and the spectrometer, and the other was corrosion of the DCA parts by use of acidic samples at the ICP system. The former was solved by adopting many lens and the latter, by flushing the DCA stand with a part of fresh air supplied for the glove box. The performance tests with nonradioactive materials showed that despite the above modifications, background equivalent concentration values were retained as almost the same as those of original, commercial spectrograph with one emission system. (author).

48998 (LA–11884-MS) **An apparatus for studies of hydrogen isotope exchange over metals using laser-Raman spectroscopy.** Carstens, D.H.W. Los Alamos National Lab., NM (USA). Oct 1990. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE90018038. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

An apparatus that uses laser-Raman spectroscopy measures the dynamic gas composition and pressure of mixed hydrogen isotopes as they exchange over hydride-forming metals or alloys. Data for the exchange of protium and deuterium over ZrCo alloy at 260°C indicate that this alloy begins exchanging at temperatures only slightly above room temperature and rapidly and completely exchanges at the higher temperature. The method is suitable for studies of bulk hydrogen/metal interactions. 10 refs., 3 figs.

48999 (LBL–26455, pp. 130) **Far-infrared laser Stark spectroscopy of the Σ bending vibration of ArHCl.** Robinson, R.L.; Gwo, D.H.; Saykally, R.J. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A complete analysis of the far-infrared laser Stark/microwave double-resonance spectrum of the ℓ bending vibration of ArHCl is given. Hyperfine-resolved spectra of the R(0), R(1), R(2), and P(1) transitions were measured near 25 cm^{-1} for both chlorine isotopes. Accurate values for the band origins, rotational constants, dipole moments, and quadrupole hyperfine constants were obtained. Comparison with Hutson's close-coupling calculations provide very strong support for the existence of a secondary minimum in the intermolecular potential surface at the linear ArClH geometry.

49000 (LBL–26455, pp. 130-131) **Tunable far-infrared laser spectroscopy of van der Waals bonds: Extended measurements on the lowest Σ bend of ArHCl.** Busarow, K.L.; Blake, G.A.; Laughlin, k.B.; Cohen, R.C.; Lee, Y.T.; Saykally, R.J. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A tunable far-infrared laser system has been used to measure the vibration-rotation spectrum of the lowest Σ bending state of ArHCl near 24 cm^{-1} in a continuous-wave planar jet operating with a terminal jet temperature near 3 K. Over 60 transitions have been observed for both ^{35}Cl and ^{37}Cl isotopes with resolution of the quadrupole hyperfine structure. An improved set of molecular parameters was determined, including B, D, H, and eqQ for both upper and lower states. Very narrow linewidths (approximately 300 kHz) resulting in high resolution and sensitivity make this technique a powerful new method for detailed investigation of intermolecular forces.

49001 (LBL–26455, pp. 159) **Transition metal-catalyzed conversion of CO, NO, H_2, and organic molecules to fuels and petrochemicals.** Bergman, R.G. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The goal of this program is the development of new chemical reactions in which transition metals interact with organic materials, and the understanding of how these reactions work. A recent discovery on this project was the finding that certain hydridoiridium and -rhodium complexes undergo oxidative addition into the carbon-hydrogen bonds of completely saturated hydrocarbons (M + R-H → R-M-H). This finding was the first example of this long-sought alkane C-H activation reaction; research is now being directed at examining the scope, selectivity, and mechanism of the process, and in developing ways to convert the activated metal complex R-M-H into functionalized organic molecules. During the current year, progress was made on the functionalization problem by uncovering a modified iridium system that effects dehydrogenation of the activated alkane. In a second study, activation of the very strong vinyl C-H bond in ethylene was investigated; evidence for the intervention of a transient intermediate other than the iridium-ethylene π-complex was obtained. Further progress was made toward understanding the thermodynamic driving force of the C-H oxidative addition process, and a flash kinetics spectrometer was constructed that is capable of infrared detection of transient organometallic species (similar to those involved in C-H activation) and measurement of the rates of their rapid reactions.

49002 (LBL–26455, pp. 159) **Synthesis of an (η^3-allyl)(hydrido)iridium complex and its reactions with arenes and alkanes. Sequential intermolecular C-H oxidative addition and hydride-to-alkene migratory insertion reactions.** McGhee, W.D.; Bergman, R.G. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The iridium allyl hydride complex (η^5-C_5Me_5)(η^3-C_3H_5)(H)Ir has been prepared from [(η^5-C_5Me_5)$IrCl_2$]$_2$, and its reaction with arenes and alkanes has been investigated. The hydride reacts with C-H bonds in benzene and cyclopropane in the presence of phosphines L, leading to the phenyl and cyclopropyl complexes (η^5-C_5Me_5)(L)Ir(n-propyl)(R). Irradiation of 1 in the presence of PMe_3 takes a different course, giving the previously uncharacterized (η^5-C_5Me_5)Ir(PMe_3)$_2$. Thermal reaction of 1 in alkane solvents such as n-butane and i-butane, which are capable of β-elimination, leads to products formed by replacement of the allyl group in 1 by a substituted allyl ligand generated by overall dehydrogenation of the alkane. Thermolysis of 1 in the presence of arenes such as n-propylbenzene and cumene leads to more complicated products resulting from intermolecular C-H activation followed by cyclometallation and/or dimerization.

49003 (LBL–26455, pp. 160-161) **Infrared flash kinetic spectroscopy of transients generated by irradiation of (η^5-C_5H_5)Co(CO)$_2$ in the gas phase and in solution.** Wasserman, P.; Bergman, R.G.; Moore, C.B. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The photoinduced ligand substitution chemistry of (η^5-C_5H_5)Co(CO)$_2$ in the gas and solution phases has been studied by using laser flash kinetic spectroscopy with fast infrared detection. The data are consistent with primary loss of one CO to form an unsaturated species that is trapped rapidly by solvent to give a reactive solvate complex. In the absence of other ligands, the solvate reacts with starting dicarbonyl, leading to $Cp_2Co_2(CO)_3$. Dative ligands L [e.g., C_2H_4 in the gas phase or P(n-C_4H_9)$_3$ in cyclohexane solution] react rapidly with the solvate, leading to adducts of general formula CpCo(CO)(L). The rates of these bimolecular addition reactions have been measured for several ligands. In general, the unsaturated intermediate reacts with the ligands at rates close to those of diffusion in both media, which indicates that the open site of the coordination sphere may be only weakly solvated in alkane solutions. Solvation complexes of this intermediate with benzene and tetrahydrofuran in cyclohexane solution were produced; these solvates are far less reactive than the cyclohexane solvate. the benzene solvate appears to react with the ligand through both direct and indirect pathways. The rate constants for these reactions have been determined.

49004 (LBL–26455, pp. 163) **Actinide chemistry.** Edelstein, N.M.; Andersen, R.A.; Raymond, K.N.; Streitwieser, A. Jr.; Zalkin, A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and*

Chemical Sciences Division annual report, 1988. Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The purpose of this project is to study actinide materials in order to provide the basic knowledge necessary for their safe and economic utilization in present and future technology. The program includes the preparation of new gaseous, liquid, and solid phases and studies of their physical and chemical properties. Techniques for characterization include x-ray diffraction, optical and vibrational spectroscopy, magnetic resonance, and magnetic susceptibility. From these complementary studies, new insights into the structural and chemical principles of actinide compounds are obtained with which to design new synthetic schemes to produce new materials. A major aspect of the program is the design and synthesis of sequestering agents for actinide ions. These compounds are intended for use in the treatment of actinide poisoning and for possible application in the treatment of spent reactor fuels. Preparative, structural, and physical studies of new types of organoactinide, related organolanthanide, and new actinide inorganic complexes are continuing. Studies on optical spectra of free ions and actinide ions in crystals are being pursued in order to understand their electronic structure. The primary goal of this work is to develop and characterize chelating agents that specifically and effectively sequester actinide ions. Biological studies are also performed at LBL to assess the effectiveness of the chelating agents to remove actinides in vivo.

49005 (LBL–26455, pp. 163-164) **Kinetically inert lanthanide amine complexes.** Smith, P.H.; Reyes, Z.E.; Lee, C.W.; Raymond, K.N. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Chelating agents to complex actinide(IV) ions have been developed using a biomimetic approach founded on the ligand structures of naturally occurring iron(III) sequestering agents called siderophores. The present study emphasizes the encapsulation aspects of such metal-ion binding. A series of macrocyclic lanthanide amine complexes has been prepared by the addition of bis(dimethylamino)methane to one equivalent of lanthanide ion and two equivalents of triamino-triethylamine in acetontrile. These compounds have been structurally characterized, and the electrochemical potential of a ytterbium complex in acetonitrile suggests a large stabilization of the +3 state.

49006 (LBL–26455, pp. 165) **$[Li(Me_2NCH_2CH_2NMe_2)_2]$-$[Li_2(Me_2NCH_2CH_2NMe_2)_2$ (μ-η^5, η^5-MeC_5H_4)]-$[(\eta^5$-$MeC_5H_4)_6U_2(\mu$-Me)$]_2$: A compound with symmetrically bridging MeC_5H_4 and Me groups.** Stults, S.D.; Andersen, R.A.; Zalkin, A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Reaction of equimolar amounts of MeLi and $(MeC_5H_4)_3U$(thf) in $Me_2NCH_2CH_2NMe_2$ and diethyl ether gives red crystals of $[Li(Me_2NCH_2CH_2NMe_2)_2]$-$[Li_2(Me_2NCH_2CH_2NMe_2)_2(\mu$-$\eta^5,\eta^5$-$MeC_5H_4)][(\eta^5$-$MeC_5H_4)_6U_2(\mu$-Me$)]_2$ in 19% yield. Single-crystal x-ray crystallography; monoclinic, $C_{2/c}$, a = 18.093(4) Å, b = 21.706(6)Å, c = 27.233(6) Å, b = 97.53(3)°, Z = 4, R = 0.053 [2,165 data, $F^2 > 3\sigma(F^2)$], shows that the compound is composed of two cationic fragments, $[Li(Me_2NCH_2CH_2NMe_2)_2]$ and $[Li_2(Me_2NCH_2CH_2NMe_2)_2(\mu$-$\eta^5,\eta\eta^5$-$MeC_5H_4)]$ ring, i.e. an inverted sandwich structure. The bonding in this inverted sandwich fragments is presented.

49007 (LBL–26455, pp. 165-166) **The structures of bis[bis(trimethylsilyl)-cyclopentadienyl](chloro)uranium(III) - [bis(t-butylisocyanide)] and bis[bis (trimethylsilyl) cyclopentadienyl] - (chloro)uranium(III) [bis(t-butylcyanide)].** Beshouri, S.M.; Zalkin, A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

In an attempt to explore the lability of the uranium(III) and chlorobridged dimer $[Cp_2'' = C_5H_3(SiMe_2)_2]$, toward Lewis basis, reactions were undertaken using tertbutylcyanide $[NC\text{-}C(CH_3)_3]$ and tert-butylisocyanide $[CN\text{-}C(CH_3)_3]$. The reaction of $(Cp_2''UCl)_2$ with these ligands (L) is facile forming five coordinate uranium(III) complexes of the generator formula $Cp_2'UCl \times 2L$. Both complexes were prepared via the same synthetic procedure.

49008 (LBL–26455, pp. 167) **Tris[bis (trimethylsilyl) amido] (trimethylsilylimido)uranium(V).** Zalkin, A.; Brennan, J.G.; Andersen, R.A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

$[((CH_3)_3Si)_2N]_3 = UNSi(CH_3)_3$ was prepared during a systematic synthetic and comparative x-ray crystallographic study of monomeric pentavalent uranium compounds. The crystals are rhombohedral, R3c, with a = 12.495(4) Å and α = 89.83(3)° at 23°C; for Z = 2 the calculated density is 1.373 g/cm^3. The structure was refined to an R factor of 0.027 for 1,194 data with $F^2 > 3\sigma F^2$. The uranium(V) atom is on a threefold axis at the center of a tetrahedron of nitrogen atoms. Distances are: U=N, 1.910(16) Å; U-N 2.295(10) Å; (Si-N), 1.728 ± 0.027 Å; (Si-C), 1.91 ± 0.04 Å.

49009 (LBL–26455, pp. 167) **Di-μ-oxo-bis(bis(trimethylsilyl)cyclopentadienyl)uranium(IV)).** Zalkin, A.; Beshouri, S.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

$((((CH_3)_3Si)_2C_5H_3)_2UO)_2$ was generated as a side product of the reaction of bis(trimethylsilyl)cyclopentadienyl uranium(III) complexes with unsaturated molecules, and it is believed to be formed as a result of oxygen contamination. The crystals are monoclinic, $P2_1/n$, with a = 15.648(3) Å, b = 15.951(3) Å, c = 12.195(3) Å, and β = 99.99(2)° at 23°C; for Z = 2 the calculated density is 1.49 g/cm^3. The structure was refined by full-matrix least squares to an R factor of 0.036 for 2,997 data $[F^2 > 2\sigma(F^2)]$. The dimeric complex, in which two $(Me_3Si)_2C_4H_3U$ moieties are bridge bonded by two oxygen atoms, lies on a center of symmetry. Distances are: U-O, 2.096(6), 2.129(6) Å; (U-C), 2.77(3) Å (U-Cp), 2.497(4) Å.

49010 (LBL–26455, pp. 168) **Bis[bis(t-butyl)cyclopentadienyl]uranium chloride.** Zalkin, A.; Stuart, A.L.; Andersen, R.A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

$(((Me_3C)_2C_5H_3)_2UCl)_2$ was prepared as part of a systematic synthetic and x-ray crystallographic study aimed at elucidating the solid-state stereochemistry and geometrical alterations in trivalent uranium metallocenes as a function of coordination environment. The crystals are orthorhombic, Pccn, with a = 13.040(3) Å, b = 17.086(3) Å, and c = 24.587(3) Å at 23°C; for Z = 4 the calculated density is 1.523 g/cm^3. The structure was refined by full-matrix least squares to an R factor of 0.027 for 1293 data with $F^2 > 2\sigma(F^2)$. Two $((Me_3C)_2C_5H_3)UCl$ groups form a double chlorine-bridged dimer in which the uranium atom is bonded to two cyclopentadienyl rings and to two chlorine atoms with J-Cp and U-Cl distances of 2.516 and 2.856(4) Å, respectively.

49011 (LBL–26455, pp. 168) **Bis[(bis (trimethylsilyl) cyclopentadienyl] - chloro) uranium(III) bis (2,6-dimethylphenylisocyanide).** Zalkin, A.; Beshouri, S.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

$((Me_3Si)_2C_5H_3)_2ClU \times 2(CNC_6H_3Me_2)$ was prepared by reaction of one equivalent of $((C_5H_3(SiMe_3)_2)_2UCl)_2$ with four equivalents of $CN(Me_2C_6H_3)$ in diethyl ether solution. The product was dissolved in hexane solution, and dark crystals were isolated after cooling at −20°C. The crystals are monoclinic, $P2_1/n$, with a = 16.000(4) Å, b = 22.806(4) Å, c = 13.093(3) Å, and β = 92.85(2)° at 23°C. For Z = 4 the calculated density is 1.33 g/cm^3. The structure was refined by full-matrix least squares to an R factor of 0.031 for 4,116 $[F^2 > 2\sigma(F^2)]$ of 8,437 total unique data. The uranium atom is five coordinate, with the following distances: U-Cl, 2.6865(20) Å; U-Cp, 2.505, 2.508 Å; U-C(isocyanide), 2.654(9), 2.681(9) Å; and (U-C(cyclopentadiene)), 2.781(11) Å.

49012 (LBL–26455, pp. 169) **Bis(bis (trimethylsilyl) cyclopentadienyl) (bromo) uranium(III)bis (t-butylisocyanide).** Beshouri, S.M.; Zalkin, A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report,*

1988. Order Number DE90003301. Source: NTIS, PC A11/MF A01.

$((Me_3Si)_2C_5H_3)_2UBr \times 2(CNCMe_3)_2$ was prepared by reaction of one equivalent of $((C_5H_3(SiMe_3)_2)_2UBr_2)$ with four equivalents of $CN(CMe_3)$ in diethyl ether solution; the product was dissolved in hexane, and dark crystals were isolated after cooling to – 20°C. The crystals are monoclinic, $P2_1/n$, and a = 11.765(3) Å b = 12.135(2) Å, c = 30.125(5) Å, β = 92.29(2)°, and V = 4,297.5; for Z = 4 the calculated density is 1.396 g/cm^3. The crystal structure was determined using monchromated MoKα x rays. The structure was refined by full-matrix least squares to an R factor of 0.033 using 4,281 ($F^2 > 2\sigma(F^2)$) of 7,592 total unique data. The uranium atom is five coordinate, with the following distances: U-Br, 2.8761(10) Å; U-Cp, 2.514, 2.520 Å; U-C(isocyanide), 2.662(8), 2.697(7) Å and (U-C(cyclopentadiene)), 2.791(18) Å.

49013 (LBL–26455, pp. 169) **Bis (bis (trimethylsilyl) cyclopentadienyl) (chloro) uranium(III)bis(trimethylsilylcyanide).** Zalkin, A.; Beshouri, S.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

$((Me^3Si)_2C_5H_3)_2UCl \times 2(NCSiMe_3)_2$ was prepared by reaction of one equivalent of $((C_5H_3(SiMe_3)_2)_2UCl)_2$ with four equivalents of $NCSiMe_3$ in diethyl ether solution. The product was dissolved in hexane, and dark green crystals were isolated after cooling at –20°C. The crystals are monoclinic, $P2_1/n$, with a = 11.602(2) Å, b = 36.947(5) Å, c = 10.999(2) Å, and β = 99.31(2)°. For Z = 4, the calculated density is 1.272 g/cm^3. The structure was refined to an R factor of 0.041 for 4,138 ($F_2 > 2\sigma(F_2)$) of 6,929 total unique data. The uranium atom is five coordinate, with the following distances: U-Cl, 2.698(3) Å; U-Cp, 2.510, 2.520 Å; U-N(cyanide), 2.592(11), 2.619(10) Å; and (U-C(cyclopentadiene)), 2.789(22) Å (see figure 11-1).

49014 (LBL–26455, pp. 169-170) **Structure of rubidium uranyl(VI) trinitrate.** Zalkin, A.; Templeton, L.K.; Templeton, D.H. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Crystals of $RbUO_2(NO_3)_3$ were prepared for study of x-ray dichroism with synchrotron radiation, and the structure was redetermined to check the symmetry and molecular orientation, to obtain the anisotropic thermal parameters, and as part of an investigation of uranium-oxygen bond distances. The crystals are hexagonal, R3c, with dimensions a = 9.384(4) Å and c = 18.899(6) Å. For Z = 6 the x-ray density is 3.743(4) g/cm^3. Least-squares refinement of the structure resulted in an R factor of 0.014 for 261 independent reflections with $I > 2\sigma(I)$. The uranyl ion is coordinated in bidentate fashion by three nitrate ions in its equatorial plane. Bond lengths are U-O = 1.746(4) Å (uranyl), 2.474(3) Å (nitrate); N-O = 1.205(6) Å (terminal), 1.268(4) Å (bridge). The anomalous scattering term f for U measured at 0.71 Å is –10.7(2).

49015 (LBL–26455, pp. 170) **Bis (bis (pentamethylcyclopentadienyl) Ytterbium(III)) ditelluride.** Zalkin, A.; Berg, D.J. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The complex was isolated from the reaction of $Yb(C_5(CH_3)_5)_2 \times O(C_2H_5)_2$ with a large excess of tellurium powder in hexane after stirring for two days at room temperature. Crystals of $((Me_5C_5)_2Yb)_2Te_2$ are monoclinic, $P2_1/n$, with a = 15.517(3) Å, b = 10.611(2) Å, c = 13.166(3) Å, and β = 114.34(2)°; for Z = 2 the calculated density is 1.92 g/cm^3. The structure was refined to an R factor of 0.036 for 3,330 ($F_2 > 2\sigma(F_2)$) of 4,560 total unique data. The Te_2^{-2} ion is on a center of symmetry and lies perpendicular to and in between the two Yb atoms. Each Yb atom is bonded approximately tetrahedrally to two cyclopentadienyl rings centers and the Te_2^{-2} ion. Distances are: (Yb-C), 2.626(17) Å; (Yb-Cp(centroid)), 2.332(18) Å; and Te-Te, 2.7686(11) Å.

49016 (LBL–26455, pp. 170) **$(Me_5C_5)_2Yb(\mu\text{-}H_3B)(PMe_3)$: A complex with a near-linear BH_3 bridging group.** Burns, C.J.; Andersen, R.A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Addition of $(Me_5C_5)_2Yb$ to H_3BPMe_3 gives the 1:1 coordination compound, $(Me_5C_5)_2Yb(\mu\text{-}H_3B)(PMe_3)$, with BH_3 bridging the Yb and P centers so that $(Me_5C_5)_2Yb$ is a Lewis acid and the borane portion of H_3BPMe_3 is the Lewis base. The small perturbations upon coordination and the similarity between $(Me_5C_5)_2Yb(\mu\text{-}Me)BeC_5Me_5$, in which the hydrogen atoms on the bridging methyl group were located and refined, and $(Me_5C_5)_2Yb(\mu\text{-}H_3B)PMe_3$ strongly suggest that the CH_3- and BH_3 portions are bonded to $(Me_5C_5)_2Yb$ in a similar fashion, i.e., by way of Yb···H-B and Yb···B interactions. The BH_3 portion in the 1:1 coordination compound may be viewed in much the same way as the bridging BH_4- group (BH_3L is isolobal with BH_4- and CH_4) in metal tetrahydroborate complexes is viewed.

49017 (LBL–26455, pp. 171) **Reaction of $(Me_5C_5)_2Yb$ with fluorocarbons: Formation of $(Me_5C_5)_4Yb_2(\mu\text{-}F)$ by intermolecular C-F activation.** Burns, C.J.; Andersen, R.A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Addition of C_6F_6 and other fluoroaromatics and fluoroolefins, though not C_2F_6 or 1,1,1-CF_3CH_3, to $(Me_5C_5)_2Yb$ gives the mixed-valence complex $(Me_5C_5)_4YB_2(\mu\text{-}F)$ with a linear, asymmetric Yb(II)- F-Yb(III) bond. The unusual intermolecular reaction of fluorocarbons with $(Me_5C_5)_2Yb$ is complex. In a qualitative sense, the C-F activation does not depend only upon the averaged C-F bond dissociation energy, since C_6F_6 (D = 154 kcal/mol) is activated whereas C_2F_6 (D = 127 kcal/mol) is not. The functional group and solvent dependence suggest that a polarizable functional group on the fluorocarbon and a vacant coordination site on the metal is necessary for efficient activation, forming perhaps a weak complex similar to the isolated molecule, $(Me_5C_5)_2Yb(\eta^2\text{-}MeC{\equiv}CMe)$. In addition, the electron affinity of the fluorocarbon and the strength of the metal-to-fluorine bond are important.

49018 (LBL–26455, pp. 171-172) **Electron-transfer chemistry of $(Me_5C_5)_2Yb$: Cleavage of diorganoperoxide and related chalcogenides to give $(Me_5C_5)_2Yb(ER)(L)$ where e is O, S, Se, or Te and L is a Lewis Base; crystal structure of $(Me_5C_5)_2Yb(TePh)(NH_3)$.** Berg, D.J.; Andersen, R.A.; Zalkin, A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The divalent metallocenes of ytterbium, $(Me_5C_5)_2Yb(OEt_2)$ or $(Me_5C_5)_2Yb(NH_3)_2$, react with molecules of the type REER to give the trivalent ytterbium complexes $(Me_5C_5)_2Yb(ER)(L)$, where L is OEt_2 or NH_3; E is S, Se, or Te; and R is a phenyl or substituted phenyl group. The peroxides, ROOR, where R is Me_3C or Me_3Si, give the alkoxides $(Me_5C_5)_2Yb(OR)(NH_3)$, and $Et_2NC(S)SS(S)CNEt_2$ gives the known $(Me_5C_5)_2Yb(S_2CNEt_2)$. In contrast, dialkyl-dithiophosphinates give $(Me_5C_5)_2Yb(S_2PR_2)$ and R_2PPR_2, where R is Me or Et. The synthetic routes developed in this work, are the best methods currently available for synthesis of these trivalent species. The crystal structure of $(Me_5C_5)_2Yb(TePh)(NH_3)$ has been done. The crystals are orthorhombic, $P2_12_12_1$, with a = 11.823(3) Å, b = 25.917(6) Å, c = 8.539(2) Å, and V = 2,616.5 Å. For Z = 4, the calculated density is 1.69 g/cm^3. The structure was refined by full-matrix least squares to a conventional R factor of 0.046 (4,991 data, $F^2 > \sigma(F^2)$). The Yb-Te distance is 3.039(1) Å, and the Yb-Te-C(Ph) angle is 113.0(3)°.

49019 (LBL–26455, pp. 173-174) **Analysis of the $5f^1 \rightarrow 6d^1$ transitions in PaX_6^{2-} (X = Cl, Br) and $Pa^{4+}/ThBr_4$.** Edelstein, N.; Krupa, J.C.; Naik, R.C.; Rajnak, K.; Whittaker, B.; Brown, D. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The $5f^1$ configuration is an attractive system to study because of the simplicity of its electronic spectrum. In addition, for Pa^{4+} in compounds, absorption bands due to the interconfigurational $4f^1 \rightarrow 6d^1$ occur in the visible region. Thus one has the almost unique opportunity to study the $6d^1$ configuration in a solid compound. The optical spectra of $Pa^{4+}/ThBr_4$ and M_2PaX_6 (M = Cs, X = Cl; M = NEt_4, X = Cl, Br) in the visible and ultraviolet ranges have been

obtained and are analyzed in terms of a Hamiltonian including the crystal-field and spin-orbit interactions for the 6d configuration. A lower limit of ~ 13,800 cm^{-1} is obtained for the total crystal-field splitting of PaX_6^{2-}. Spin-orbit coupling constants of ζ_{6d} = 2,050 cm^{-1} (PaX_6^{2-}) and ζ_{6d} = 1,570 cm^{-1} ($Pa^{4+}/ThBr_4$) are obtained. The crystal-field analyses of the $6d^1$ configuration have shown that both the crystal-field and spin-orbit coupling parameters are much smaller than might have been expected by extrapolation of the data available for the $4d^1$ systems, Ce^{3+} and $TaCl_6^{2-}$.

49020 (LBL–26455, pp. 174) **Optical study and analysis of Pu^{4+} in single crystals of $ZrSiO_4$.** Poirot, I.S.; Kot, W.K.; Edelstein, N.M.; Abraham, M.M.; Finch, C.B.; Boatner, L.A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Optical spectroscopic investigations of the narrow absorption and fluorescence spectra of trivalent lanthanide and actinide ions doped in single crystals of various hosts have been studied for over 30 years. The parametric theory used to interpret these spectra has been quite successful for these ionic systems. The same theory applied to the tetravalent actinide ion U^{4+}, however, results in fits to the experimental spectra that are much worse than those found for the trivalent lanthanide or trivalent actinide ions. One would expect the conventional parametric theory, which works so well for the trivalent ions, to be more successful when applied to the heavier Z actinides. Optical data have been reported and analyzed previously for the actinide ions U^{4+} and Np^{4+} diluted in $ZrSiO_4$. In this paper, the electronic structure of tetravalent plutonium incorporated as a dilute impurity in single crystals of the tetragonal host $ZrSiO_4$ has been studied using polarized optical spectroscopy. Fifty-three crystal-field levels were assigned and used to obtain a fit to a parametric Hamiltonian to within an rms deviation of 33 cm^{-1}. The resulting crystal-field parameters were similar to those obtained for the U^{4+}:$ZrSiO_4$ and Np^{4+}:$ZrSiO_4$ systems. The parametric fit improved with increasing atomic number from U^{4+} to Pu^{4+}, suggesting that the tetravalent actinides are indeed more lanthanide-like as the atomic number increases.

49021 (LBL–26455, pp. 174) **Revision and additions to the energy levels of neutral cerium, ^{244}Cm I.** Blaise, J.; Worden, E.F.; Conway, J.G. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

New spectroscopic data obtained using isotopically different samples have led to revisions and additions to the energy levels of neutral curium, ^{244}Cm I. There are now 491 odd and 432 even energy levels with J-values. Almost all the levels have isotope shifts, and many have g-values and configuration designations. Ten odd configurations and nine (one tentative) even configurations have been identified.

49022 (LBL–26455, pp. 176) **Anomalously small 4f-5d oscillator strengths and 4f-4f electronic Raman scattering cross sections for Ce^{3+} in crystals of $LuPO_4$.** Williams, G.M.; Edelstein, N.; Boatner, L.A.; Abraham, M.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The oscillator strengths for the $4f^1 \rightarrow 5d^1$ transitions of Ce^{3+} in $LuPO_4$ were measured from absorption spectra and compared to calculated values. The energy-level diagram for Ce^{3+} ($4f^1$ and $5d^1$ configurations) is shown. The measured oscillator strengths were found to be between 2.5 to 20 times smaller than the corresponding theoretical values. In addition, absolute cross sections for electronic Raman scattering between the levels of the $4f^1$ configuration of Ce^{3+} in $LuPO_4$ were measured and found to be significantly smaller than those expected from theory. When the calculated values of the absolute cross sections were weighted empirically by the measured $4f^1 \rightarrow 5d^1$ oscillator strengths, good agreement was obtained between the experimental and calculated values. Both of these discrepancies may be explained by a reduction in the radial integral, (4f/4/5d), for Ce^{3+} in the solid state. Absorption data obtained from the literature for the $4f^1 \rightarrow 5d^1$ transitions of Ce^{3+} in a number of host crystals were used to establish an inverse correlation between the magnitude of the cerium ion-ligand distance and the reduction in the (4f/4/5d) integral.

49023 (LBL–26455, pp. 177) **Intensities of electronic Raman scattering between crystal-field levels of Ce^{3+} in $LuPO_4$: Nonresonant and near resonant excitation.** Williams, G.M.; Becker, P.C.; Conway, J.G.; Edelstein, N.; Boatner, L.A.; Abraham, M.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The relative intensities of the electronic Raman scattering between individual crystal-field states of the $4f^1$ configuration of Ce^{3+} in $LuPO_4$ are compared to those calculated using the standard second-order theory and also by explicitly evaluating the sum over the virtual intermediate states using the crystal-field wavefunctions for the $4d^1$ configuration. The results show that the explicit calculation predicts the observed relative intensities much more accurately than the standard theory. In addition, a change in the incident laser energy from the argon ion green line (514.5 nm, 19,429.7 cm^{-1}) to that of the frequency-tripled output of a Nd^{3+}:YAG (355 nm, 28,191.5 cm^{-1}) results in enhancements of the electronic Raman scattering intensities by factors on the order of 100. These enhancements are accurately predicted by the explicit calculation.

49024 (MINTEK-M–402) **The preparation of synthetic fusion standards for use in the x-ray-fluorescence analysis of rocks and minerals.** Eddy, B.T. (Council for Mineral Technology, Randburg (South Africa). Analytical Science Div.); Jacobs, J.J. Council for Mineral Technology, Randburg (South Africa). Analytical Science Div. 30 Apr 1990. 18p. Source: Available from Mintek, Private Bag X3015, Randburg, 2125, South Africa.

The preparation of a suite of fused calibration standards for use in the X-ray-fluorescence analysis of rocks and ores is described. The suite of standards covers the minerals, ores, and slags of the elements magnesium, aluminium, silicon, calcium, titanium, vanadium, chromium, manganese, iron, and zirconium in calibration ranges from 0 to 80 or 100 per cent. The calibration standards are used in a single method for all these elements and materials. The suitability of the calibration standards, and their ability to cope with the very wide range of materials and concentration ranges, is demonstrated by the analysis of international and in-house reference materials. A detailed analysis of the factors affecting the precision of the results is also described. This set of standards is the third set that has been prepared, and many of the shortcomings and less obvious pitfalls encountered in the preparation of synthetic fusion standards have been overcome. Although the calibration standards have been designed for a particular method, they will be useful for the analysis of similar materials by other X-ray techniques. 7 refs., 7 figs., 21 tabs.

49025 (PNL-SA–18081) **Combined capillary electrophoresis and electrospray ionization mass spectrometry.** Smith, R.D.; Loo, J.A.; Edmonds, C.G.; Udseth, H.R. Pacific Northwest Lab., Richland, WA (USA). Jul 1990. 17p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AC06-76RL01830. (CONF-9007162–1: Spectroscopy across the spectra, Hertford (UK), 9-12 Jul 1990). Order Number DE90016535. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The development of new capillary electrophoresis (CE) methods provides a basis for the efficient manipulation and separation of subpicomole quantities of polypeptides and proteins. Recent advances in microscale methods, such as the demonstration of the tryptic digestion of low picomole quantities of proteins using the immobilized enzyme in small diameter packed reactor column, provide the basis for such further developments. The use of capillary (free solution) zone electrophoresis (CZE) for separation of proteins, and recent demonstrations of restriction mapping of large deoxyribonucleotides, has propelled potential CE applications into the realm of conventional electrophoresis, while adding the attributes of speed, relatively simple on-line detection, automation, and reduced sample requirements (10^{-17} – 10^{-13} mole). A literal explosion of ancillary methods for sample manipulation, derivatization, and detection as well as new methods of obtaining separation selectivity are being reported. Additionally, other CE formats are attracting increased interest, with the aim of exploiting the unique features of capillary isotachophoresis (CITP), capillary isoelectric

focusing (CIEF), capillary electrokinetic chromatograpgy (CEC), and most recently, capillary polyacrylamide gel electrophoresis (CGE). As a result, there are concomitant and increasing demands upon detector sensitivity and information density.

49026 Progress in the theory of non-linear chromatography. Czok, M. (Univ. of Tennessee, Knoxville (USA)); Golshan-Shirazi, S.; Guiochon, G.; Katti, A.M.; Ma, Z. pp. 10, Paper ANYL 33 of American Chemical Society, Division of Analytical Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

The ideal model of chromatography, which assumes an infinite column efficiency, can be solved analytically for any isotherm in the case of a single component and for the Langmuir competitive isotherm in the case of a binary mixture. These analytical solutions are presented and discussed. The numerical solutions of the semi-ideal model are compared. The effect of the finite column efficiency on the profiles is examined. Experimental results obtained with various chromatographic systems confirm the validity of the theoretical predictions.

49027 Surface-enhanced Raman spectroscopic (SERS) measurements in the liquid phase. Haas, J.W. III (Oak Ridge National Laboratory, TN (USA)); Lee, E.Y. pp. 22, Paper ANYL 72 of American Chemical Society, Division of Analytical Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

SERS measurements using electrode substrates are normally made directly in liquid phase samples. With other substrates, however, spin-coating or spotting techniques have been used almost exclusively. Nevertheless, in some cases (e.g. in situ monitoring) it may be desirable to make direct, liquid phase measurements. This paper addresses some of the important factors relevant to this approach; substrate stability, solvent effects, and analyte concentrations. A reusable substrate with greater stability has been developed to improve the precision of analytical measurements.

49028 Readily-accessible oxidation of d^0 organozirconium compounds: The electronic structure of $(\eta^5\text{-}C_5H_5)_3ZrX$ compounds. Strittmatter, R.J. (Ohio State Univ., Columbus, OH (USA)); Bursten, B.E.; Rhodes, L.F.; Morris, D.E.; Rogers, R.D. pp. 90, Paper INOR 313 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

In an effort to obtain a comparison between organotransition metal and organoactinide complexes, a series of Cp_3ZrX compounds have been synthesized. A single crystal X-ray crystallographic study of Cp_3ZrCl reveals that all three Cp ligands are bound in an η^5 fashion. Electrochemical investigations of this series show a first oxidation of these d^0 compounds approximately one volt less positive than the d^0 Cp_2ZrX_2 compounds and approximately one-half volt less positive than the d^0f^0 Cp_3ThCl compound. These results will be presented along with a discussion of the electronic structure of this series, as determined by $X\alpha$-SW and Fenske-Hall calculations.

49029 Calibration of the ^{14}C timescale over the past 30,000 years using mass spectrometric U-Th ages from Barbados corals. Bard, E. (Columbia Univ., Palisades, NY (USA). Lamont-Doherty Geological Observatory); Hamelin, B.; Fairbanks, R.G.; Zindler, A. *Nature (London) (UK)*, 345(6274): 405-410 (31 May 1990).

Uranium-thorium ages obtained by mass spectrometry from corals raised off the island of Barbados confirm the high precision of this technique over at least the past 30,000 years. Comparison of the U-Th ages with ^{14}C ages obtained on the Holocene samples shows that the U-Th ages are accurate, because they accord with the dendrochronological calibration. Before 9,000 yr BP the ^{14}C ages are systematically younger than the U-Th ages, with a maximum difference of ≈3,500 yr at ≈20,000 yr BP. The U-Th technique thus provides a way of calibrating the radiocarbon timescale beyond the range of dendrochronological calibration. (author).

4002 Inorganic, Organic, and Physical Chemistry

Refer also to citation(s) 48082, 48096, 48216, 48222, 48491, 48503, 48504, 48505, 48506, 48507, 48508, 48509, 48510, 48511, 48729, 48888, 48929, 48938, 48950, 48966, 49001, 49002, 49003, 49005, 49006, 49007, 49008, 49009, 49010, 49011, 49012, 49013, 49014, 49015, 49016, 49017, 49018, 49019, 49020, 49021, 49022, 49023, 49105, 49124, 49126, 49127, 49128, 49131, 49132, 49133, 49137, 49142, 49157, 49158, 49204, 49282, 49370, 49387, 49388, 49395, 49461, 49558, 49882, 49883, 49884, 49885, 50086, 50226, 50232

49030 (AD-A–222603/3/XAB) **Dynamical solvent effects on electron-transfer processes: Recent progress and perspectives. Technical report.** Weaver, M.J.; McManis, G.E. Purdue Univ., Lafayette, IN (USA). Dept. of Chemistry. 1 May 1990. 31p. Contract N00014-89-J-1452. (TR–97). Source: NTIS, PC A03/MF A01.

Recent advances in theoretical and experimental aspects of dynamical solvent effects in activated electron-transfer processes are discussed, along with future research prospects. The last decade has seen a remarkable upsurge of interest in the dynamical role of the solvent in liquid-state chemical processes. Along with the intrinsic importance of such phenomena in chemistry and biology, these activities have been fostered by substantial recent developments of both a theoretical and experimental nature. The central concept of solvent friction, whereby the collective solvent motion necessary to surmount the activation barrier slows the rate below that expected from transition-state theory (TST), 1a-c has spawned a myriad of theoretical treatments that attempt to describe the effective solvation dynamics.

49031 (AD-A–222605/8/XAB) **Ionic atmosphere effects on the energetics of thermal and optical electron-exchange reactions: Application to ferrocenium-ferrocene self exchange. Technical report.** Kuznetsov, A.M.; Phelps, D.K.; Weaver, M.J. Purdue Univ., Lafayette, IN (USA). Dept. of Chemistry. 1 May 1990. 28p. Contract N00014-89-J-1452. (TR–95). Source: NTIS, PC A03/MF A01.

A treatment of ionic-atmosphere effects upon symmetrical electron-transfer reactions resulting from added electrolyte is outlined. Relationships are derived on the basis of the extended Debye-Huckel model for the increase in the activation free energy, associated with reorganization of the ionic atmosphere for homogeneous-phase reactions involving a pair of spherical reactants with varying internuclear distance R. Similar relationships apply to the energetics of symmetrical optical electron transfer, since the increase in the optical transition energy, should equal the corresponding ionic atmosphere reorganization energy, under the anticipated linear response conditions.

49032 (CBPF-MO–001/89, pp. 37-59) **Local dielectric effects and the calculation of thermodynamic functions of ion solvation within a born continuum approach.** Contreras, R. (Chile Univ., Santiago (Chile). Dept. de Quimica); Padilla, L.A.; Gomes, J.S.; Aizman, A. Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1988. (CONF-8809499–: 6. Latin American School on Theoretical Chemistry, Rio de Janeiro (Brazil), 11-17 Sep 1988). In *6. Latin American School on Theoretical Chemistry. v. 1.* Source: Available from the Library of the Comissao Nacional de Energia Nuclear, RJ, Brazil.

The reaction field theory of continuum solvent effects is used to introduce dielectric saturation effects to provide the local reaction field model. The model is build up from classic electrostatics. The quantum mechanical implementation of the model is discussed in detail. (A.C.A.S.).

49033 (CONF-900802–10) **The chemistry of plutonium(VI) in aqueous carbonate solutions.** Stout, B.E. (Florida State Univ., Tallahassee, FL (USA). Dept. of Chemistry); Choppin, G.R.; Sullivan, J.C. Argonne National Lab., IL (USA). [1990]. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 200. American Chemical Society national meeting; Washington, DC (USA); 26-31 Aug 1990. Order Number DE90017839. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The dynamic behavior of carbonate ion as a ligand that interacts with the hexavalent actinyl ions of U, Np, and Pu has been examined by ^{13}C NMR. The first order rate parameter that describes the exchange between bulk solution and bound carbonate decreases with increasing pH. At a pH of 10.0, 25°C, the respective values of k for the U(VI), Np(VI) and Pu(VI) complexes are 27.1 ± 0.3, 64.7 ± 3.3 and 706 ± 29. The variation of k with temperature was used to calculate the values of ΔH^+ = 53 and 42 kJ/M; and ΔS^+ = −40 and −71 J/M-K for the uranyl and neptunyl systems, respectively. A plausible reaction scheme for the exchange reaction is considered. The influence of these slow carbonate exchange reactions on selected electron transfer reactions is noted. 19 refs., 4 figs., 2 tabs.

49034 (IS-M–620) **Oxidation of chromium(II) by hydroxylamine-O-sulfonic acid.** Simunic, J.L.; Espenson, J.H.; Bakac, A. Ames Lab., IA (USA). [1988]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. (CONF-8806491–1: 22. reaction mechanisms conference, Pittsburgh, PA (USA), 12-16 Jun 1988). Order Number DE90016701. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

When hexaaquochromium(II) reacts with hydroxylamine-O-sulfonic acid (HSA) in acidic media, the major product of the reaction is $CrNH_3^{3+}$ rather than the expected $CrSO_4^+$ or Cr^{3+}. Stoichiometric studies indicate that two moles of Cr^{2+} are consumed per mole of HSA. The rate law for the reaction is $-d[Cr^{2+}]/2dt = -d[HSA]/dt = k_0 + k_1 [Cr^{2+}][HSA]$ with $k_0 = 0.2\ s^{-1}$ and $k_1 = 9.7\ M^{-1}s^{-1}$. 7 refs.

49035 (LBL–26455, pp. 117) **A new method for surface structure using a combination of second harmonic generation and coverage-dependence fluorescence.** Harris, C.B.; Peterson, E. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A number of phenomena that occur at surfaces are sensitive to the geometry and orientation of adsorbate molecules. Two-dimensional energy transfer via dipole-dipole coupling, for example, varies both with intermolecular distance and with the relative orientation of the dipole moments. In addition, resonant second harmonic generation (SHG) is able to define the angle between the transition dipole of an absorption band and the surface normal, but not the position of the molecule about this surface normal. A combination of SHG and a simple dipole-dipole interaction model was developed as a new technique for determining adsorbate geometries on surfaces. General formulae for absorption-band shifts using the geometry constraints imposed by the SHG data were derived for a dimer constructed from two arbitrarily placed monomers on the surface. These formulae can be used to determine the orientation of the two monomers relative to each other. Finally, a simplified version of this formalism was used to interpret absorption band shifts for a system of rhodamine B adsorbed on quartz. A subclass of possible molecular geometries can be defined from the overlap of the distributions predicted by each method alone.

49036 (LBL–26455, pp. 118) **Fundamental studies of bond breaking and forming on ultrafast timescales.** Harris, C.B.; Brown, J.K.; Smith, D.E. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A series of experiments has been completed that show that the traditional stochastic theories for chemical reaction dynamics in liquids are not valid without significant modification. Stochastic theories based on the Langevin or Fokker-Planck equations for describing physical phenomena break down when thermal fluctuations no longer look completely random. For many condensed-matter phenomena, this occurs on the picosecond or femtosecond timescale. For bond breaking and forming processes in liquids, this time corresponds to collision times. In addition the first direct time-resolved measurement of predissociation and curve crossing in a solution-phase chemical reaction was made. Results show that predissociation may be much more rapid ({ <=} 1 ps) than previously thought and that curve crossing in solution is extremely facile and not the rate-limiting step in recombination.

49037 (LBL–26455, pp. 118) **Studies of chemical reactivity in condensed phase.** Harris, C.B.; Brown, J.K.; Russell, D.J.; Smith, D.E. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The general question, are isolated binary collision theories valid for vibrational relaxation in liquids has been addressed. Several scaling theorems were developed that allow one to generically test the equation of whether gas-phase theories for energy redistribution are valid at liquid-state densities. Simple isolated binary-collision models qualitatively reproduce molecular dynamics relaxation behavior, yet fail to scale properly with density. It is important to include effects of correlated and many-body collision, especially correlated collisions that result from the amplitude of the vibrational motion perturbing the surrounding solvent molecules. Using the experimental results discussed above and the results of large-scale molecular-dynamics simulations, a variety of theoretical approaches have been tested for bond formation and the resulting energy dissipation to the surroundings associated with the enthalpy of the bond. The utility of stochastic dynamics based on the generalized Langevin equations to quantitatively account for the observations has been examined. Several new approaches have been developed, including the application of spectral estimation techniques used for high-speed signal processing. In particular, the memory kernal use in stochastic dynamics (generalized Langevin equations) has been constructed from a class of techniques based on estimates of autoregressive and moving average (ARMA) parameters and applied to energy dissipation via vibrational relaxation in liquids on ultrafast timescales.

49038 (LBL–26455, pp. 119) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

An extremely sensitive technique utilizing time-resolved angle-dependent multiphoton photoemission has been developed to study transient excitations of surface electrons on the femtosecond timescale. The technique yields the time-resolved energy and momentum distribution of electrons emitted from the surface and is applicable to a wide variety of problems. By using a high-repetition-rate (4 MHz) tunable fiber-compressed UV femtosecond laser, an excite pulse is used to cause transitions from the bulk states or from occupied surface states on metals to empty states above Fermi level but below the vacuum. Compensating for dispersion in a synchronously pumped dye laser, one can achieve 20-30 fs time resolution with no loss of sensitivity. As an initial experiment, the dynamics of electrons on the image potential states on Ag(111) and Cu(100) have been investigated. The kinetic-energy distribution of photoelectrons ejected by the resonant absorption of two laser photons has been measured for Ag(111) after an initial pulse excites the short-lived image state from an occupied surface state below the Fermi energy, and a second delayed pulse photoemits the electron from the image potential state. The effects of depositing controlled submonolayer coverages of xenon on silver have been initiated in order to determine whether the xenon interacts with electrons in image states as a polarizable dielectric continuum or whether isolated atom-electron interactions such as negative-ion formation predominate.

49039 (LBL–26455, pp. 120) **Rate constants for $^3CH_2$ (X^3B_1) removal by O_2, NO, and C_2H_2 from infrared-diode laser flash kinetic spectroscopy.** Darwin, D.C.; Young, A.T.; Johnston, H.S.; Moore, C.B. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Removal rates of ground-state triplet methylene (X^3B_1, $^3CH_2$) due to the reaction with O_2, NO, and C_2H_2 have been measured using laser flash kinetic spectroscopy. Excimer-laser photolysis of ketene produced $^3CH_2$. The subsequent time behavior of the $^3CH_2$ transient was recorded by directly monitoring continuous-wave diode laser absorption due to $^3CH_2$. From analysis of $^3CH_2$ decay curves under pseudo-first-order conditions, rate constants were determined. The results are in good agreement with recent, direct measurements made using flow-tube techniques, but are in poor

agreement with earlier, indirect measurements. These results illustrate the importance of direct measurements of individual rate constants for input to models of complex phenomena such as combustion and atmospheric chemistry.

49040 (LBL–26455, pp. 121) **The small-molecule limit of infrared multiphoton dissociation: Collisional effects in D_2CO.** Berman, M.R.; Moore, C.B. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

In order to understand the mechanisms of infrared multiphoton excitation in the small-molecule limit, D_2CO was studied by monitoring infrared fluorescence from stretching modes of D_2CO following excitation in the bending modes. The dependence of the infrared multiphoton dissociation yield on laser wavelength, on laser power, and on reactant and foreign gas pressures was also studied. Severe bottlenecks to excitation through the first few steps are found. Vibration-to-vibration transfer of a bending quantum from one excited D_2CO molecule to another is a crucial step. Collision-induced changes of rotational quantum number must also play an important role.

49041 (LBL–26455, pp. 123-124) **Near-critical NaCl-H_2O: An equation of state and discussion of anomalous properties.** Pitzer, K.S.; Tanger, J.C. IV. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The system NaCl-H_2O near the critical point of pure water shows not only the remarkable properties of any two-component system near the critical point of one component but also an anomalous curvature of the T-x and P-x projects of the critical line in the range below mole fraction 0.0005. An equation of state is presented that is based on the Haar-Gallagher-Kell equation for pure water with a few terms involving the mole fraction of NaCl together with the temperature and density. Derivatives of this equation yield densities, enthalpies, and heat capacities that are compared with experimental data. The values calculated for the apparent molar heat capacity at slightly supercritical pressure agree remarkably well with recent measurements. Also, the properties calculated for the vapor near the three-phase line are compared with those predicted by the successive hydration model previously developed for NaCl in steam in equilibrium with solid NaCl. Other related topics are discussed, including the anomalous features noted above.

49042 (LBL–26455, pp. 124) **An ionic system with critical point at 44°C.** Singh, R.R.; Pitzer, K.S. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The coexistence curves are known for only a very few ionic systems, but in each case they show an apparent critical exponent of 1/2 instead of the value near 1/3 shown by all nonionic systems. It is of great interest to determine whether this value of 1/2 for the critical exponent remains valid very close to the critical point or, possibly, shifts to a value near 1/3. In order to investigate this question, an ionic system was sought that had a critical point near room temperature where sensitive measurements and precise temperature control would be possible. Such a system has been discovered; it is composed of triethyl-n-hexylammonium triethyl-n-hexylboride in diphenyl ether and has a critical point at 316.7 K with mole fraction 0.052 of salt. Its coexistence curve shows a critical exponent of 1/2 to within about 1° of the critical point; more sensitive measurements are now in progress. In the course of this investigation, the solubility of this liquid salt was measured for various solvents and an equation was developed that correlates these results with the two variables: (1) dielectric constant and (2) cohesive energy density (Hildebrand's solubility parameter).

49043 (LBL–26455, pp. 124) **Equation of state in the acentric-factor system.** Schrieber, D.R.; Pitzer, K.S. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The acentric factor theory for fluid properties was originally presented with tabulated functions for the compressibility factor and other properties because no convenient equation of state represented fluid behavior over a wide range of conditions to the required accuracy. Now much more complex equations are convenient, and many equations have been developed that are completely defined when T_c, P_c, and ω are given. An equation is developed to best meet the following criteria: (1) accuracy of representation of measured properties over a wide range of conditions, (2) accurate agreement with the observed near-critical properties, (3) simplicity of form, and (4) computational convenience. The acentric-factor system is an approximation, and agreement to the best experimental accuracy is not expected. Comparisons with experiment are presented to indicate the precision that can be expected for various regions and for the critical isotherm (see Figure 3-1). The equation is further tested by comparisons of calculated enthalpies. The behavior of the effective critical exponent β_e in the near-critical region is examined.

49044 (LBL–26455, pp. 124-125) **Thermodynamics of electrolyte mixtures. Activity and osmotic coefficients consistent with the higher-order limiting law for symmetrical mixing.** Yang, J.Z.; Pitzer, K.S. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The parameters for symmetrical mixing of ions of the same sign in the virial-coefficient (Pitzer) system are evaluated from literature data for 298.15 K in a manner consistent with the higher-order limiting law of Friedman. Twenty-four systems involve cation mixing with a common anion, and fourteen involve anion mixing with a common cation. Heat of mixing data were similarly treated in a recent publication; the results give the temperature coefficients of some of these same parameters. The combined results yield the mixing parameters as functions of temperature on a basis both self-consistent and in accord with the limiting law. The results also yield, for a few systems without a common ion, predicted values in good agreement with experimental data.

49045 (LBL–26455, pp. 125-126) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The liquid-liquid coexistence curve for the newly discovered ionic system is being extended closer to the critical point at 43.6°C by refractive-index measurements at very precisely controlled temperatures. The study of differences between vapor-liquid and liquid-liquid coexistence curves (Publication 5) is being extended to the region very close to the critical point.

49046 (LBL–26455, pp. 128) **Theoretical study of the interaction of Fe, Fe^+, and FeCO with Ar.** Braga, M.; Almeida, A.L.; Taft, C.A.; Hammond, B.L.; Lester, W.A. Jr. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Ab initio Hartree-Fock calculations were performed on $FeAr^+$ and $FeAr^+$ in order to determine the interaction of both neutral and singly ionized Fe atoms trapped in Ar, and on ArFeCO and FeCOAr in order to ascertain the effect of an Ar matrix on the FeCO molecule. Quadrupole splitting and isomer shifts are computed using ab initio orbital populations and charge densities scaled by a relative factor. Good agreement between calculated and experimental hyperfine parameters is found in each case. The interaction energy for Fe^+-Ar was computed using both ab initio Hartree-Fock and effective core potential (ECP) methods. Both approaches yield a minimum between Fe^+ and Ar at approximately 7.6 bohr.

49047 (LBL–26455, pp. 131) **Tunable far-infrared laser spectroscopy of van der Waals bonds: Vibrational-rotation-tunneling spectra of Ar-H_2O.** Cohen, R.C.; Busarow, K.L.; Laughlin, K.B.; Blake, G.A.; Havenith, M.; Lee, Y.T.; Saykally, R.J. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The first high-resolution spectra of a rare gas-H_2O cluster have been observed using a tunable far-infrared laser to probe the

vibration-rotation-tunneling levels of Ar-H_2O formed in a continuous planar supersonic jet. The high sensitivity of this spectrometer facilitated extensive measurements of two perpendicular subbands, which are assigned to transition from the ground state to the upper component of a hydrogen-exchange tunneling doublet (c-type) at 21 cm^{-1} and to $\nu_{b1} = 1^+$ (b-type) at 25 cm^{-1}, the lower tunneling component of a bending vibration that is perpendicular to the tunneling coordinate. The tunneling splitting is shown to be in the range 2.5-7 cm^{-1}, and the lower tunneling component of the excited bending vibration lies between 39 and 43 cm^{-1} above the ground state of the complex. The experimentally determined center-of-mass separation (R_{cm} = 3.7 Å) and harmonic stretching force constant (k_s = 0.0134 mdyn/Å) are compared to those of related first- and second-row hydrides. The large-amplitude motions occurring within this complex make it difficult to establish its structure.

49048 (LBL–26455, pp. 131) **Tunable far-infrared laser spectroscopy of hydrogen bonds: The K_a = O(u) → 1 (g) rotation-tunneling spectrum of the HCl dimer.** Blake, G.A.; Cohen, R.C.; Laughlin, K.B.; Lee, Y.T.; Saykally, R.J. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The ground state K_a = 0(u) → 1(g) b-type subband of the rotation-tunneling spectrum of the symmetric ^{35}Cl–^{35}Cl, ^{37}Cl-^{37}Cl, and the mixed ^{35}Cl – ^{37}Cl hydrogen chloride dimers have been recorded near 276.3 cm^{-1} with sub-Doppler resolution in a continuous two-dimensional supersonic jet with a tunable far-infrared laser spectrometer. Quadrupole hyperfine structure from the chlorine nuclei has been resoled. From the fitted rotational constants a $(H^{35}Cl)_2$ center-of-mass separation of 3.81 Å is derived for the K_a = 1(g) levels, while the nuclear quadrupole coupling constants yield a vibrationally averaged angular structure for both tunneling states of approximately 20-25° for the hydrogen-bonded proton and at least 70-75° for the external proton. This nearly orthogonal structure agrees well with that predicted by ab initio theoretical calculations, but the observed splittings and intensity alterations of the lines indicate that the chlorine nuclei are made equivalent by a large-amplitude tunneling motion of the HCl monomers. A similar geared internal-rotation tunneling motion has been found for the HF dimers, but here the effect is much greater. The ground-state tunneling splittings are estimated to lie between 15-18 cm^{-1}, and the selection rules observed indicate that the trans tunneling path dominates the large-amplitude motion, as expected, provided the dimer remains planar. From the observed hyperfine constants, the authors judge the dimer and its associated tunneling motion to be planar to within 10°.

49049 (LBL–26455, pp. 132) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The authors are now developing tunable far-infrared laser techniques for studying reactive molecules generated by excimer laser photolysis and van der Waals complexes. Ultimately these will possess extremely high sensitivity and resolution such that subtle effects on hydrogen tunneling migration effects can be explored in fluxional radicals like vinylidene and vinyl radical.

49050 (LBL–26455, pp. 141) **Crossed molecular beams.** Lee, Y.T. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The major thrust of this research project is to elucidate the details of the dynamics of simple elementary reactions that are theoretically important and to unravel the mechanism of complex chemical reactions or photochemical processes that play important roles in many macroscopic processes. Molecular beams of reactants are used to study individual reactive encounters between molecules or to monitor photodissociation events in a collision-free environment. Most of the information is derived from measurement of the product fragment energy and angular distributions. Recent activities are centered on the mechanisms of elementary chemical reactions involving oxygen atoms with unsaturated hydrocarbons, the dynamics of endothermic substitution reactions, the dependence of the chemical reactivity of electronically excited atoms on the alignment of excited orbitals, the primary photochemicals processes of polyatomic molecules, intramolecular energy transfer of chemically activated and locally excited molecules, the energetics of free radicals that are important to combustion processes, the infrared-absorption spectra of carbonium ions and hydrated hydronium ions, and bond-selective photodissociation through electric excitation.

49051 (LBL–26455, pp. 152) **Formation of oxyacids of sulfur from SO_2.** Connick, R.E. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Stimulus for this research is the existence of acid rain. Coal-burning power plants produce sulfur dioxide, which is oxidized in air to form sulfuric acid, the principal component of acid rain. In most commercial flue-gas desulfurization processes, the sulfur dioxide is absorbed in an aqueous solution of low acidity, where it may be oxidized by O_2. Control of the rate of this latter reaction is of major importance to these processes. While recent research of this project has been concentrated on this reaction, investigation of the fundamental chemistry of species formed from sulfur dioxide and reactions of these species remains the primary goal. The oxidation-reduction chemistry of sulfur should be studied, particularly reactions between two oxidation states of the element, e.g., reactions involving HSO_3^-, H_2S, S_8, and the polythionates. A secondary and not closely related goal is to determine the factors controlling the rate of substitution reactions in the first coordination sphere of metal ions in solution. Computer modeling has been extended to three dimensions, and configurations of activated complexes have been determined. The usual concept of a transition state with reflection coefficient near unity is quite inadequate.

49052 (LBL–26455, pp. 153) **Potentially catalytic and conducting polyorganometallics.** Peter, K.; Vollhardt, C. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The task being carried out under this program is the design and execution of organic methodology aimed at allowing access to sequences of linked strong π-ligands to transition metals. The synthetic approaches are designed to be efficient, readily performed, and so adaptable as to allow control over the sequence of the attached metals. In this way, a number of novel transition-metal arrays have become available in which the metallic centers adopt unnatural linear and angular configurations. It is anticipated that these structures will give rise to hitherto unobserved reactivity and potential catalytic activity when exposed to small organic molecules. Moreover, such transition-metal chains provide ideal models for probing the elementary steps of multimetallic ligand and electron transfer. Continued progress is being made in the synthetic aspects of this project, resulting in novel systems in which several cyclopentadienyl units have been linked and complexes to transition metals. The first total syntheses of ter- and quatercyclopentadienyl tri- and tetrametals have been announced, including a trisheterometallic system containing the sequence of molybdenum, rhenium, and tungsten. The discovery of exciting preliminary chemistry of these systems, including thermally and photochemically induced intramolecular ligand transfers, has justified the original premise of this research. Current efforts are focused on exploring the reactivity patterns of the structures under investigation and expanding the ligand chain.

49053 (LBL–26455, pp. 153) **On the way to ligating oligocyclopentadienyls: Synthesis and preliminary reactivity of the two isomeric tercyclopentadienyls and their transition-metal complexes.** Newman, D.A.; Vollhardt, K.P.C.; Boese, R. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The first rational synthesis of trinuclear transition-metal complexes of the two isomeric tercyclopentadienyl ligands is described. The synthetic strategy, which is general, utilizes the alkylating ability of 3-chloro-2-cyclopentenone in the presence of cyclopentadienyl anions, including fulvalene dianion, to introduce a new masked cyclopentadienyl ligand. In this way, several trinuclear metal arrays with or without metal-metal bonds have been constructed attached

to three linked cyclopentadienyl fragments and bearing additional ligands that may migrate along the trimetallic chain. The latter property seemingly depends on stereoelectronic factors. The intramolecular nature of such a transfer involving methyl has been established by a crossover experiment with specifically deuterium-labeled (tercyclopentadienyl)tritungsten(nonacarbonyl)methyl.

49054 (LBL–26455, pp. 153-154) **The chemistry of (fulvalene)-molybdenumruthenium(pentacarbonyl).** Huffman, M.A.; Vollhardt, K.P.C. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Photolysis of $FvMoRu(CO)_5$ in the presence of alkynes leads to two types of molybdenum-bound alkyne complexes: $Fv(CO)_2RuMo(CO)(RC \equiv CR')$ (R = R′ = Ph; R = R′ = 4-MeC_6H_4; R = Ph; R′ = $SiMe_3$) and $Fv(CO)_2RuMo(CO)_2$ (RC ≡ Cr′) (R = R′ = Ph; R = Ph; R′ = $SiMe_3$). An x-ray crystallographic study of one of the tricarbonyl derivatives (R = R′ = Ph) reveals the presence of a four-electron-donating alkyne ligand bound to Mo. Variable-temperature NMR studies indicate fluxionality via two processes. Addition of O_2 to one of the tetracarbonyl analogs gives the known oxo complex $Fc(CO)_2RuMo(O)$ (PhC ≡ CPh) and CO_2, and of S_8 the molybdenadithiolene $Fv(CO)_2MoRu(CO)$ [SC(Ph) = C(Ph)S]. Photosubstitution of the title complex by terminal alkynes provides side-bound, bridging vinylidenes $Fv(CO)_2MoRu(CO)[\mu = \eta^1:\eta^2\text{-}C = C(H)R]$ (R = Ph, R = $SiMe_3$).

49055 (LBL–26455, pp. 154-155) **Models for organometallic polymers: Zigzag chains of $Mo_2(O_2CCH_3)_4$ units linked by dimethylphospinoethane (dmpe) and tetramethylethylenediamine (tmeda) ligands.** Kerby, M.C.; Eichhorn, B.W.; Creighton, A.J.A.; Vollhardt, K.P.C. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Attempted oligomerization of dinuclear metal complexes is frequently hampered by the alternative formation of clusters. This work describes a potential solution to this problem by the utilization of bidentate ligands. Thus, infinite zigzag chains with repeating $Mo_2(O_2CCH_3)_4$ units are recovered from neat solutions containing dmpe and tmeda. X-ray studies of the light yellow dmpe polymer $1/\infty[Mo_2(O_2CCH_3)_4(dmpe)_2]$, and its light yellow tmeda analog, $1/\infty[Mo_2(O_2CCH_3)_4(tmeda)_2]$, reveal nearly isomorphic structures. The former belongs to the space group P1 (−135°C), with a = 8.473 (2) Å, b = 9.562 (3) Å, c = 7.654 (3) Å, α = 110.59 (2)°, β = 100.06 (2)°, γ = 69.26 (2)°, Z = 1, V = 541.9 (3) Å^3, R = 0.058, and R_w = 0.058. The latter belongs to the space group P1 (20°C), with a = 8.388 (1) Å, b = 8.445 (2) Å, c = 8.840 (2) Å, α = 105.95 (2)°, β = 115.62 (1)°, γ = 91.63 (2)°, Z = 1, V = 535.1 (2) Å^3, R = 0.025, and R_w = 0.033.

49056 (LBL–26455, pp. 160) **C-H insertion and π-complex formation reactions of $(\eta^5\text{-}C_5Me_5)(PMe_3)Ir$ with ethylene: An intra- and intermolecular isotope-effect study.** Stoutland, P.O.; Bergman, R.G. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Thermolysis of $(\eta^5\text{-}Me_5C_5)(PMe_3)Ir(C_6H_{11})(H)$ at 130-160°C in cyclohexane in the presence of ethylene results in formation of $(\eta^5\text{-}Me_5C_5)(PMe_3)Ir(HC{=}CH_2)(H)$ (1) and $(\eta^5\text{-}Me_5C_5)(PMe_3)Ir(H_2C{=}CH_2)$ (2) in a ratio of 2:1. The x-ray structure of complex 1 has been determined; this is the first simple transition-metal vinyl hydride that has been fully characterized in this way. The π-complex 2 is completely stable to the reaction conditions, and thermolysis of 1 in cyclohexane or benzene above 180°C results in quantitative conversion to 2. To determine the mechanism of the vinyl C-H insertion, thermolysis of $(\eta^5\text{-}Me_5C_5)(PMe_3)Ir(C_6H_{11})(H)$ in the presence of several deuterated ethylenes was carried out. Competition experiments involving ethylene and ethylene-d_4 allow determination of an intermolecular isotope effect for insertion into a C-H(D) bond. The intermolecular isotope effect for formation of 2 was found to be 0.82 ± 0.05. The different intra- and intermolecular isotope effects for C-H insertion require an intermediate (other than the π-complex 2) on the reaction pathway leading to 1. A complex having an ethylene C-H bond coordinated to iridium is suggested as the structure of this intermediate.

49057 (LBL–26455, pp. 161) **The thermodynamic driving force for C-H activation at iridium.** Stoutland, P.O.; Bergman, R.G.; Nolan, S.P.; Hoff, C. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

This paper discusses the relationship between the intermolecular oxidative addition reaction of carbon-hydrogen bonds in organic molecules to transition-metal centers, and the dissociation energies of the C-H, M-H, and M-R bonds that undergo changes during this process. Earlier studies of transition-metal M-H and M-R bond energies are reviewed, followed by a summary of relative and absolute bond energies measured more recently for the C-H inserting $(\eta^5\text{-}C_5Me_5)(PMe_3)Ir$ system. The M-H and M-R energies are unusually large in this system compared with most others that are presently known; important exceptions are those in the thorium series, where intermolecular C-H activation is also observed. The $(\eta^5\text{-}C_5Me_5)(PMe_3)Ir(X)(Y)$ bond-energy values are utilized in discussing the propensity of iridium for intermolecular C-H insertion, and in predicting thermochemistries for its R-H insertion and M(H)(R) reductive elimination reactions. Finally, the physical basis for the strong metal-carbon and -hydrogen bonds in the iridium system is discussed.

49058 (LBL–26455, pp. 161-162) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Nearly all the metal complexes that so far have been found to undergo efficient oxidative addition to carbon-hydrogen bonds have a cyclopentadienyl (Cp)-type ligand attached to the metal. In current work, efforts are under way aimed at developing non-Cp-containing C-H activation systems, so that the role played by this ligand in the oxidative addition process can be better understood. In a second line of investigation, utilizing the knowledge gained in studying C-H activation systems involving complexes with one metal center, projects are under way aimed at developing two-center (dinuclear) complexes that will activate C-H bonds. In such systems, the second metal center will be employed to introduce functionalizing reagents and to help rationally modify the reactivity and selective of the activation process.

49059 (LBL–26455, pp. 164) **Complexation of lanthanide(III) ions by catechol and similar ligands.** Zhu, D.H.; Kappel, M.J.; Raymond, K.N. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The solution complexation chemistry of Eu(III) and Lu(III) with catechol and several monocatecholates (e.g., tiron, DMBS) were investigated using potentiometric and spectrophotometric methods. These two trivalent lanthanides form complexes of the same composition, with those of Lu(III) more stable. Complexes of Eu(III) with catechol of 1:1, 1:2, and 1:3 are formed at pH 8.0, 10.0, and 12.0, respectively. The overall formation constant, log β, of trivalent lanthanides with tetracatechol is ~20. This value is to be compared with a log β { >=} 50 for lanthanide(IV) and actinide(IV) with tetracatechol. The latter value demonstrates that very stable actinide(IV) tetracatecholate complexes are formed, thereby making catechol a potential chelating agent for actinide(IV) in vivo.

49060 (LBL–26455, pp. 166) **Tris (methylcyclopentadienyl) uranium(III)-ammonia.** Rosen, R.K.; Zalkin, A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The crystal structure of $(MeC_5H_4)_3U \times NH_3$ was determined in order to examine the role of steric effects on the U-L bond length in a series of $(MeC_5H_4)_3U{\times}L$ compounds, where L = ammonia, 4-dimethylaminopyridine, and quinuclidine. The compound was prepared by the addition of an ammonia-saturated toluene solution to a solution of $(MeC_5H_4)_3U \times OC_4H_8$, and the red-brown needles were crystallized from ether at −20°. The crystals are monoclinic, Im, with cell dimensions a = 12.129(3) Å, b = 24.197(5) Å, c =

8.725(3) Å, and β = 92.85°. for Z = 6 the calculated density is 1.92 g/cm^3. The structure was refined to an R factor of 0.037 [4,247 data, $F^2 > 3\sigma(F^2)$]. There are two independent molecules in the unit cell. Although the orientation of components of the two molecules is different, the bond distances and angles are comparable within the estimated statistics, and chemically the two are identical. The uranium atom is bonded to three cyclopentadienyl rings and to an ammonia molecule, with (U-C), (U-ring), and (U-N) distances of 2.81(5), 2.55(3), and 2.61(3) Å, respectively.

49061 (LBL–26455, pp. 172) **Electron exchange between potassium bis(t-butyl(8)annulene)ytterbate(II) and potassium bis(t-butyl(8)annulene)ytterbate(III).** Eisenberg, D.C.; Kinsley, S.A.; Streitwieser, A. Jr. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Exchange on the ^{1}H NMR time scale has been observed between potassium bis([8]annulene)ytterbate(II) and potassium bis([8]annulene)ytterbate(III). The absence of exchange between potassium bis([8]annulene)calcate(II) and potassium bis([8]annulene)ytterbate(III) demonstrates that the measured exchange is electron exchange rather than ligand exchange. Rates of exchange have been determined between the corresponding t-butyl derivatives, potassium bis(t-butyl[8]annulene)ytterbate(II) and potassium bis(t-butyl[8]annulene)ytterbate(III), by NMR line-broadening techniques; typical second-order rate constants are 5 x 10^7 M^{-1} sec^{-1} at 19.3°C in tetrahydrofuran (THF), and 1 x 107 M^{-1} sec^{-1} in THF containing diglyme. The enthalpy of activation is about 7 Kcal mol^{-1}, and the entropy of activation is close to zero. From these activation parameters and the effect of the more strongly solvating diglyme, a mechanism is proposed that involves change in coordination of solvating diglyme.

49062 (LBL–26455, pp. 172-173) **1,5-disubstituted cyclooctatetraenes.** Lyttle, M.H.; Streitwieser, A.; Miller, M.J. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Bulky groups in cyclooctatetraene rings have been shown earlier to confer marked air stability to uranocene derivatives. New and improved routes have been developed for the preparation of 1,5-di-t-butylcyclooctatetraene, 1B, and 1,5-diphenylcyclooctatetraene, 1P. These compounds were prepared from 1,5-cyclooctadiene in ten steps and in 11% and 1% overall yield, respectively. An alternative route gave the diphenyl compound in 10% overall yield in eight steps, but this route was not effective for the t-butyl derivative. Both pathways share a common, appropriately substituted intermediate, 5-phenyl-9-oxabicyclo[3.3.1.]nonan-1-o1, and 5-t-butyl-9-oxabicyclo[3.3.1.]nonan-1-o1. 1,1′,5,5′-tetra-t-butyluranocene prepared from 1B was stable to water and substantially insensitive to air.

49063 (LBL–26455, pp. 175) **On the stability and bonding in bis(η-arene)lanthanide complexes.** Anderson, D.M.; Cloke, F.G.N.; Cox, P.A.; Edelstein, N.; Green, J.C.; Pang, T.; Sameh, A.A.; Shalimoff, G. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Cocondensation of atoms of the lanthanide elements with 1,3,5-tri-t-butylbenzene gives the thermally stable bis(η-arene)lanthanide(0) sandwich compounds for the lanthanides Nd, Tb, Dy, Ho, Er, and Lu, thermally unstable complexes for La, Pr, and Sm, and unisolable materials for Ce, Eu, Tm, and Yb. In considering the bonding in these compounds, [Y(η-^{t}Bu$_3$C$_6$H$_3$)$_2$] is taken to be the prototype molecule. In an 18-electron bis(η-arene) transition-metal sandwich complex, the highest occupied molecular orbitals (HOMOs) are the largely metal-based a_{1g} and e_{2g} orbitals. By analogy with the yttrium compound, it is reasonable to propose that, to a first approximation, a 4f^{m}d^{1}s^2 (n = 0-14) configuration is required in either the ground or an easily accessible excited state of the lanthanide atom in order to form a stable bis-arene lanthanide compound. The magnetic properties of the complexes provide a testing ground for this model of their electronic structure. Three limiting cases for interaction between the three e_2 electrons and the f electrons can be found. Calculated and experimental values for the compounds are given. Cases 2 and 3 provide the same calculated values of the magnetic moments. In general, the success f these rather naive models in explaining the magnetic properties of these unusual compounds, plus the systematics of the promotion energies to the 4f^{m}d^{1}s^2 configuration, support the proposed bonding scheme whereby three of the valence electrons of the lanthanide are involved in bonding to the arene rings and the rest remain in the f shell.

49064 (LBL–26455, pp. 177-180) **The electronic structure of organometallic complexes of the f elements - XXIII. Interpretation of the magnetochemical and optical data of a tetrahydrofuran adduct derived from tris(η^5 cyclopentadienyl)-ytterbium(III).** Amberger, H.D.; Schultze, H.; Reddmann, H.; Shalimoff, G.V.; Edelstein, N.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Numerous optical and magnetic studies have been performed for adducts of $Cp_3Yb \times L$($Cp = \eta^5$-C_5H_5), where L is a Lewis base. In contrast to $Cp_3Ln \times L$ (Ln = Ce-Er) compounds of the lighter lanthanides, optical spectra of $Cp_3Yb \times L$ compounds exhibit vibronic transitions with intensities comparable to the purely electronic transitions. The magnetic susceptibilities of $Cp_3Yb \times L$ (L = THF, γ picoline) in the temperature range 5-300 K and the electron paramagnetic resonance spectra of these two compounds at low temperature have been measured. In this paper the assignments of Amberger and Schultze derived from the optical spectrum of $Cp_3YB \times$ THF and the new magnetic data have been used to derive preliminary values of the spin-orbit coupling constant and the crystal-field parameters for $Cp_3Yb \times L$ compounds. Given the limited data available, satisfactory fits have been obtained.

49065 (LBL–26455, pp. 181) **Correlation of liquid heat capacities for fossil fuels using characterization data.** Rodgers, P.A.; Creagh, A.L.; Prausnitz, J.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Heat capacities for liquid fossil-fuel fractions are correlated as a function of characterization data. The correlation uses molecular weight from freezing-point-depression or gel-permeation-chromatography measurements, molar hydrogen-to-carbon ratio from elemental analysis, hydrogen distribution from proton nuclear-magnetic-resonance data, and, if available, number of methyl, hydroxyl, primary amine, and secondary amine groups per molecule from infrared spectroscopy. The correlation is established for temperatures below 500 K using characterization data for 118 pure hydrocarbons; the average deviation from experiment is 2.3%. When the correlation is used to predict the heat capacities of nine petroleum fractions, the average deviation is 2.6%. Average deviations for 14 coal-derived liquids are about 6.6%, but for those liquids containing more than about 3 wt% oxygen, the average deviation is somewhat lower. For high-oxygen-containing fractions, the correlation presented here is significantly better than that of Mraw et al.

49066 (LBL–26455, pp. 181-182) **A correlation for thermodynamic properties of heavy fossil-fuel fractions.** Schwarz, B.J.; Prausnitz, J.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A correlation is developed for calculation of thermodynamic properties of heavy fossil fuels, based on a recent version of the perturbed-hard-chain equation of state. Since the correlation does not require experimental vapor pressures or densities as input data, it is useful for heavy fossil fuels where vapor pressures and densities are difficult or impossible to measure. For fossil-fuel fractions, equation-of-state parameters are found from approximate molecular-structure (characterization) data coupled with a calibration based on pure-component (model compound) data. Interaction parameters are given for mixtures of fossil fuels with methane, ethane, carbon dioxide, hydrogen, and hydrogen sulfide. While the correlation presented here is useful for calculating vapor-liquid equilibria, it is not intended for conventional fossil fuels, where

other correlations are satisfactory. Instead, it is intended for heavy fossil fuels where conventional correlations are often not reliable and where the usual input data are often unavailable.

49067 (LBL–26455, pp. 182) **Molecular thermodynamics of partially ordered fluids: Microemulsions.** Hu, Y.; Prausnitz, J.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Mixtures of water, oil, and surfactant often form microemulsions where tiny drops of oil (or water) are dispersed in a matrix of water (or oil). A microemulsion is a partially ordered fluid in which the surfactant molecules exist in an oriented layer at the boundary between the continuous phase and the discontinuous phase. This work proposed a molecular thermodynamic model that is useful for calculating a variety of phase diagrams observed in microemulsion-forming systems. The model is based on a revised form of Widom's abstract representation of a microemulsion: that representation provides a procedure for calculating essential contributions to the configurational entropy. In Widom's representation, all molecules are difunctional dumbbells such that all the hydrophilic ends are situated together in some lattice sites and all the lipophilic ends are situated together in other sites. A form of Guggenheim's quasichemical theory is used to evaluate the combinatorial contributions that correspond to Widom's picture. Chemical association of surfactant molecules and physical interactions are also taken into account. Minimization of the Gibbs energy yields a distribution function for representing micelle sizes. Calculated ternary phase diagrams are in good agreement with experimental results. Different types of diagrams can be obtained upon changing physically significant model parameters. A study of how these parameters affect phase behavior provides insight on microemulsion stability.

49068 (LBL–26455, pp. 182) **Computational aspects of a noncubic equation of state for phase equilibrium calculations. Effect of density-dependent mixing rules.** Topliss, R.J.; Dimitrelis, D.; Prausnitz, J.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

An efficient procedure is presented for solving a noncubic equation of state for density. In phase-equilibrium calculations, the costly computing step is not the density calculation but the calculation of the equation-of-state constants for the mixture. Illustrative calculations are given for high-pressure phase equilibria for hydrogen/ethane and methane/water. These calculations show the superiority of noncubic equations with density-dependent mixing rules.

49069 (LBL–26455, pp. 182) **High-temperature mutual solubilities for some binary and ternary aqueous mixtures containing aromatic and chlorinated hydrocarbons.** Hooper, H.H.; Michel, S.M.; Prausnitz, J.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Mutual solubilities at the three-phase equilibrium pressure have been measured for binary mixtures of water with 1,2-dichloroethane and chlorobenzene in the temperature range 75-200°C. Liquid-liquid equilibria were measured for ternary aqueous mixtures containing toluene and phenol at 150 and 200°C and for ternary aqueous mixtures containing thiophene and pyridine at 100 and 150°C. Results are given for equilibrium compositions of both liquid phases and for three-phase equilibrium pressures.

49070 (LBL–26455, pp. 182-183) **Extraction of fatty-acid methyl esters with supercritical carbon dioxide.** Wu, A.H.; Stammer, A.; Prausnitz, J.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A flow apparatus was constructed to measure vapor-phase compositions of systems containing fatty-acid methyl esters as solute and supercritical carbon dioxide as solvent at 65 to 200 bar. The equilibrium cell consists of a packed bed of liquid (or solid) solute coated on an inert solid support that is commonly used in gas-chromatographic columns. Experimental measurements were obtained for five binary systems containing methyl myristate, methyl stearate, methyl oleate, methyl linoleate, or methyl laurate. Each system was measured at 40°C and 60°C and at pressure below the critical point of the mixture. In addition, a ternary system containing carbon dioxide, methyl oleate, and methyl linolate was measured at 40°C and 107 bar. The measured solubility data were correlated using an equation of state that has a perturbation term of the van der Waals form and a reference system proposed by Boublik and Mansoori. A quadratic mixing rule with one binary parameter is suitable for these mixtures.

49071 (LBL–26455, pp. 183) **Correlation of liquid-liquid equilibria for some water-organic liquid systems in the region 20-250°C.** Hooper, H.H.; Michel, S.; Prausnitz, J.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A group-contribution model of the UNIFAC type is used to correlate liquid-liquid equilibria for water-organic liquid systems over a wide temperature range. Good agreement with experiment is obtained using temperature-dependent water-organic interaction parameters. This correlation may be useful for engineering design for processing of fossil fuels.

49072 (LBL–26455, pp. 184-185) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Efforts are directed at experimental and molecular-thermodynamic studies of: (a) high-pressure vapor-liquid equilibria in multicomponent aqueous systems containing salts and common gases; (b) liquid-liquid equilibria for aqueous systems containing organic fluids; (c) high-pressure liquid-liquid equilibria in aqueous systems containing polymers, salts, and carbon dioxide; (d) solubilities and micellization of agricultural products in compressed carbon dioxide; (e) phase equilibria in aqueous mixtures containing water-soluble polymers, salts, and biomolecules; (f) enzyme-catalyzed transesterification in compressed carbon dioxide; (g) phase equilibria in the critical region of binary and ternary mixtures; and (h) phase equilibria for aqueous systems containing gels and organic solutes.

49073 (LBL–26455, pp. 209) **Semiconductor materials and devices.** Haller, E.E. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The recently achieved ultrahigh purity and crystalline perfection of large germanium single crystals and, to a lesser degree, silicon and gallium arsenide single crystals have led to the discovery of a large number of novel impurity and defect complexes that exhibit energy levels in the band gap of these semiconductors. Understanding the composition and electronic structure of these novel acceptors and donors through the use of sensitive far-infrared spectroscopy techniques and radioactive tracer schemes represents one component of this research effort. Two factors have helped in identifying the structure and composition of these novel shallow acceptors and donors: (1) unusual electronic ground-state structures with reduced symmetry, and (2) correlation with the materials involved in the crystal growth and purification, such as the crucible material (typically synthetic silica or graphite) and the ambient (typically H_2, N_2, or vacuum). The information gained through this research is of immediate use to LBL's semiconductor radiation-detector program, which originated this research. The use of ultrapure crystals as starting material for specially doped crystals is studied in connection with the development of sensitive far-infrared photoconductors for low-photon-flux applications in outer space and neutron-transmutation-doped germanium for bolometer applications. The high ratio of intentional-dopant concentrations and residual-impurity concentrations has led to photoconductors with very high responsivity working at or close to the photon noise limits.

49074 (LBL–26455, pp. 210-212) **Infrared absorption study of neutron-transmutation-doped germanium.** Park, I.S.; Haller, E.E. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Using high-resolution far-infrared Fourier-transform absorption spectroscopy and Hall-effect measurements, the authors have studied the evolution of the shallow acceptor and donor impurity levels in germanium during and after the neutron-transmutation-doping process. Their results show unambiguously that the gallium acceptor-level concentration equals the concentration of transmutated Ge atoms during the entire doping process, indicating that neither recoil during transmutation nor gallium-defect complex formation play significant roles. The arsenic donor levels appear at full concentration only after annealing for 1 hr at 450°C. They show that this is due to donor-radiation-defect complex formation. Again recoil does not play a significant role.

49075 (LBL–26455, pp. 213) **Raman studies of surface processes.** Rosenblatt, G.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

This project is designed to utilize and develop new instrumentation for the study of surfaces using unenhanced surface Raman spectroscopy (SRS). The project's goals are to use SR to study surface composition; to provide new information concerning rotational and vibrational energy levels, dynamics, and reactivity of molecules adsorbed on a variety of surfaces; to study fundamental processes under ultrahigh-vacuum (UHV) conditions; and to extend the technique to a range of chemically important pressures, temperatures, and interfaces. An apparatus has been constructed that uses an imaging photomultiplier tube (PMT) to obtain Raman spectra that have unprecedented sensitivity and that yield a one-dimensional Raman image of sample composition along a few millimeters of an illuminating, focused laser beam. A unique capability to obtain spatially resolved compositional profiles and maps of a material's surface using the one-dimensional Raman images is under development. The Raman system is coupled to an UHV chamber that enables Raman spectra to be obtained from solid samples and films at temperatures between 15 K and 900 K. The UHV chamber has low-energy electron-diffraction (LEED) and Auger surface-analysis capabilities. This project provides a dramatic new analytical capability that compliments and contributes to other LBL surface and materials science projects.

49076 (LBL–26455, pp. 213-214) **Unenhanced surface Raman spectroscopy of nitrogen physisorbed on Ag(111).** Veirs, D.K.; Chia, V.K.F.; Rosenblatt, G.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The Raman spectrum of N_2 physisorbed on Ag(111) at 15 K has been obtained at low nitrogen exposures (4L) with low laser intensities. The Raman intensity is unenhanced and is linear with nitrogen exposure between 1 and 353 L and with laser power from 100 to 1,000 mW. The observed intensity of 7.6 counts sec^{-1} W^{-1} L^{-1} is in good agreement with an intensity calculated using the gas-phase Raman cross section. The observed line position of multilayer physisorbed nitrogen are consistent with Raman spectra in the literature for the α-phase of bulk solid nitrogen. Background scattering associated with carbon contamination and with silver islands produced during surface cleaning by alternative ion bombardment and annealing, affects the minimum detectable level of physisorbed species on silver. On a smooth, clean silver surface with a minimum of background scattering, a detection limit of less than 0.1 monolayer is calculated.

49077 (LBL–26455, pp. 215) **Spatially resolved Raman spectroscopy in the study of transformed zones in PSZ.** Veirs, D.K.; Rosenblatt, G.M.; Ritchie, R.O.; Dauskardt, R.H. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Raman vibrational spectroscopy provides an effective phase-characterization technique in materials systems containing particle dispersions of the three polymorphs of ZrO_2; the tetragonal and monoclinic phases each have a unique Raman spectrum. The authors have investigated the utilization of LBL's novel, spatially resolved Raman spectroscopy system in the study of transformed zones surrounding cracks in partially stabilized MgO-ZrO_2 (PSZ). The experimental arrangement makes use of an imaging (2D) photomultiplier tube to produce a one-dimensional Raman profile of phase compositions along a slit-like laser beam without translation of either the sample or laser beam and without scanning the spectrometer. The estimated spatial resolution is equivalent to the detector resolution of 28 μm and is not measurably reduced by secondary scattering events in the PSZ. Phase-characterization studies of the size, frontal morphology, and extent of transformation of transformation zones surrounding cracks produced under monotonic and cyclic loading conditions have been carried out. Particularly large zones were observed in peak-toughened PSZ material, extending 1,300 μm ahead of the crack tip with widths of up to 3,000 μm. Good agreement was found with transformed-zone areas determined using optical interference microscopy.

49078 (LBL–26455, pp. 215-217) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Interactions between physisorbed molecules and metal surfaces are being examined using Raman spectroscopy of N_2 and H_2 physisorbed on clean, well-characterized single-crystal silver. Preliminary investigations indicate that N_2 forms an ordered structure on Ag much like the low-temperature α-phase of solid N_2. Further studies are under way to determine the low-coverage limit of unenhanced SRS and to extend the measurements to chemisorbed systems. Other collaborative projects that are being actively pursued include: (1) Raman studies of hard carbon films, diamond-like films, and individual carbon fibers; and (2) using spatially resolved Raman to ascertain the extent of the phase-transformation zone in partially stabilized zirconia induced by crack propagation under various cyclic and monotonic loads, and dynamic in situ studies of changes in the phase-transformation zone accompanying cyclic loading of the crack.

49079 (LBL–26455, pp. 218) **Properties of cubic BN under high pressure and temperature.** Knittle, E.; Wentzcovitch, R.M.; Jeanloz, R.; Cohen, M.L. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

In spite of the fact that cubic BN has many properties that make it attractive in the manufacture of machine tools and other industrial applications, there has been no determination of its equation of state and other basic properties. Cohen and Jeanloz have performed the first complete theoretical and experimental study of the static compression of cubic BN and show that the experimental results are in excellent agreement with theoretical results based on a first-principles (LCAO) pseudopotential approach. Similar studies on compounds of B, C, and N under high pressure have also been carried out. These compounds have been synthesized inside diamond anvil cells under high-pressure and high-temperature conditions. After synthesis the compression of the samples is measured in situ inside the cell. Samples containing different ratios of C and BN have been studied, and these results are being analyzed.

49080 (LBL–26455, pp. 220-221) **The use of heteroepitaxy in the fabrication of bicrystals for the study of grain-boundary structure.** Dahmen, U.; Westmacott, K.H. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Experiments on grain-boundary structure can be grouped into two categories - those that provide limited structural information on a large number of boundaries and those that give detailed structural information on a limited sampling of boundaries. This report describes a new method for producing specimens that are particularly suitable for high-resolution observations of grain-boundary structures. Unlike the bicrystals produced by conventional methods, the specimens contain boundaries that display a continuous variation in boundary orientation. The technique simply relies on heteroepitaxy as a means of controlling the misorientation between grains during thin-film growth. For example, if the substrate surface has fourfold rotational symmetry and epitaxial overgrowth occurs in an orientation with twofold rotational symmetry, then two orientation

variants are equally probable. A systematic investigation of thin-film bicrystal structures grown by heteroepitaxy is in progress.

49081 (MINTEK-M-400) **Spectrographic determination of impurities in high-purity tantalum oxide and niobium oxide.** Anderson, S.T.G.; Russell, G.M. Council for Mineral Technology, Randburg (South Africa). Analytical Science Div. 23 Feb 1990. 11p. Source: Available from Mintek, Private Bag X3015, Randburg, 2125, South Africa.

The development of spectrographic methods by direct current arc excitation and carrier distillation for the determination of impurities in tantalum and niobium oxides are described. Iron, silicon, aluminium, titanium, calcium, silver, tin, magnesium, and manganese can be determined in tantalum oxide and niobium oxide in concentrations ranging from 3 to 300 p.p.m. Niobium can be determined in tantalum oxide in concentrations ranging from 10 to 300 p.p.m. Tantalum cannot be determined in niobium oxide, and tungsten cannot be determined in either matrix as a result of the absence of sensitive lines in the spectra of these elements. Relative standard deviations of analyte element concentrations are in the region of 0,18 for tantalum oxide samples, and 0,13 for niobium oxide samples. A detailed laboratory method is included. 4 figs., 4 tabs., 3 refs.

49082 (ORNL/FTR-3741) **[Chemical thermodynamics]: Foreign trip report, August 23, 1990–September 5, 1990.** Mesmer, R.E. Oak Ridge National Lab., TN (USA). 12 Sep 1990. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90017850. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The purpose of this travel was for the traveler to participate in the 11th IUPAC International Conference on Chemical Thermodynamics and to present a paper of which he is co-author entitled "The Transition from Strong-to-Weak Electrolyte Behavior Near the Critical Point of Water" in the session on Solutions. The conference brought together nearly 500 scientists from around the world to discuss broad aspects of experimental thermodynamics and theoretical modeling. The traveler also visited the University of Karlsruhe to discuss current research with E.U. Franck and his collaborators. This institution has been for many years one of the leading centers for experimental studies on phase equilibrium and physical chemical studies especially on pure substances under the direction of Franck.

49083 (SAND-2302C) **Formation and stability of As-H bonds in H-implanted GaAs.** Stein, H.J. Sandia National Labs., Albuquerque, NM (USA). [1990]. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900936-8: 7. international conference on ion beam modification of materials, Knoxville, TN (USA), 9-14 Sep 1990). Order Number DE91000043. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The chemical bonding and isochronal annealing of H implanted into GaAs at 80 K has been investigated by infrared absorption measurements. Based upon the frequency shift when deuterium is substituted for H, and an equivalent band formation in InAs, assignment of a new band at 2029 cm^{-1} is made to As-H centers. Bonding of H at interstitial As of and As-vacancy pair which anneals between 150 and 250K is suggested as the structure for the defect. A previously-reported absorption band at 1834 cm^{-1} assigned to Ga-H centers in H-implanted GaAS increase in intensity when H is released from As-H centers. 15 refs., 5 figs.

49084 Chemistry of anomalous-dispersion phase-matched second harmonic generation. Cahill, P.A. (Sandia National Laboratories, Albuquerque, NM (USA)); Singer, K.D. pp. 37, Paper ORGN 116 of American Chemical Society, Division of Organic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

The anomalous dispersion associated with a strong absorption in some unusual noncentrosymmetric dyes permits efficient phase-matched SHG at a given frequency and concentration. This technique was also used to demonstrate the validity of the two-state model for the second-order microscopic hyperpolarizability, β, and leads to a method of greatly enhancing second order NLO effects in poled polymer systems. The factor that primarily limits the efficiency of this process is the residual absorbance in a nearly transparent window on the high frequency side of a strong absorption band. One figure of merit for comparing dyes for this type of phase matching is the ratio between this minimum absorbance and ϵ_{max}; for many dyes this ratio is 10^{-1} to 10^{-2}.

49085 Influence of electron withdrawing groups and molecular conformation on the nonlinear optical response of derivatized phosphazenes. Exarhos, G.J. (Pacific Northwest Laboratory, Richland, WA (USA)); Samuels, W.D. pp. 63, Paper ORGN 198 of American Chemical Society, Division of Organic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

Linear polymers, $-[N{=}PR_2]_x-$, and cyclic polymer precursors based on the phosphorus-nitrogen system were found to generate second harmonic radiation. The magnitude of the observed effect correlates with the electronegativity of substitutional groups on the phosphorus atom. For example, the hexathiocyanato phosphazene trimer is more effective at SHG than the hexachloro derivative. The extent of electron shielding around the phosphorus atom, which can be determined from relative chemical shifts in the ^{31}P magnetic resonance spectrum, appears to be a good predictor of non-linear optical activity in these materials.

49086 Quantum mechanical and semiclassical studies of tunneling in hydrogen atom transfer reactions and processes involving hydrogen on metal surfaces. Truhlar, D.G. (Univ. of Minnesota, Minneapolis (USA)). pp. 64, Paper ORGN 201 of American Chemical Society, Division of Organic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

Recent research on the accurate solution of the Schroedinger equation for tunneling in simple chemical reactions as well as semiclassical approximations more suitable for polyatomic molecule reactions and reactions and diffusion processes at metal surfaces will be surveyed. This work was carried out in collaboration with several coworkers as referenced in recent papers. A recent study involves the effect of tunneling on secondary kinetic isotope effects in the reaction $CH_3 + H_2 \rightarrow CH_4 + H$.

49087 Synthesis and crystal structure of a lariat ether complex: Sodium SYM-(dibenzo-14-crown-4) methyl phenyl phosphinate pentahydrate. Burns, J.H. (Oak Ridge National Laboratory, TN (USA)); Sachleben, R.A. pp. 18, Paper INOR 59 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). DOE Contract AC05-84OR21400. (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

A macrocyclic ether has been synthesized having a phenyl phosphinic acid functional group attached as a sidearm through a methyl group. Reaction of this ligand with NaOH gave the title compound, and its structure was determined by X-ray diffraction methods. In the crystal each Na^+ ion is coordinated by the four O atoms of the crown and by two water molecules. The other three water molecules link the complexes together through hydrogen bonding.

49088 Sticky molecules in nonpolar solvents: Importance of hydrogen bonding in the hydration and aggregation of polar molecules. Moyer, B.A. (Oak Ridge National Laboratory, TN (USA)); Baes, C.F. Jr.; Bryan, S.A.; Caley, C.E.; Case, F.I.; Case, G.N.; Ripple, E.S.; Sachleben, R.A.; Willis, R.R. pp. 36, Paper INOR 120 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

Hydrogen-bonding interactions are an ever-present feature of the chemistry of polar ligands in wet nonpolar solvents. From water-content measurements at controlled water activity, the stoichiometries and water-binding constants of hydrate species may be deduced by least-squares analyses using the new program SXL-SQA. FTIR spectra of solution species together with X-ray crystal structures of model compounds provide information concerning the structural aspects of water binding.

49089 A calculational study of empirical hydrogen-bonding scales. Kober, E.M. (Los Alamos National Laboratory, NM (USA)); Faloona, I.C. pp. 36, Paper INOR 121 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

Empirical solvent scales that are purported to describe hydrogen-bonding effects, such as the Gutmann Donor and Acceptor Number scales or the alpha and beta parameters of the Taft group, often show high degrees of correlation with the solvent dependences of charge transfer transitions or redox potentials. Particularly interesting is the correlation noted by the Weaver group between Acceptor Number and the reaction entropies of charge transfer reactions. Here, a calculational study based on molecular orbital calculations and models of the electrostatic interactions is undertaken to determine the physical basis for such scales.

49090 Proton and anion binding properties of an OCTA-Aza cryptand. Smith, P.H. (Los Alamos National Laboratory, NM (USA)); Brainard, J.R.; Hay, B.P.; Ryan, R.R. pp. 76, Paper INOR 263 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

The proton and anion binding properties of the cryptand (1,4,7,10,13,16,21,24-octaazabicyclo[8.8.8]hexaeicosane), OAC, will be described. The cryptand was synthesized by Schiff's base condensation of tris(2-aminoethyl)amine and glyoxal in the presence of $Ln(III)(OAC)_3$ and subsequent reduction with $LiAlH_4$. The fluoride binding properties of OAC in aqueous solution have been studied by potentiometry and nuclear magnetic resonance. Preliminary molecular mechanics calculations of the optimum hole size for this cryptand are consistent with the observed high selectivity for the fluoride ion.

49091 Molecular mechanics study of the structure of lanthanide complexes. Hay, B.P. (Los Alamos National Laboratory, NM (USA)); Jarvinen, G.D. pp. 76, Paper INOR 264 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

The use of molecular mechanics in the are of inorganic chemistry has been hampered by the failure of most available programs to allow the input of metal complexes with coordination numbers greater than six. We have developed a method for the input of structural data to the well-known program, MM2, which provides a means of extending molecular mechanics to metal complexes of higher coordination numbers. This method has allowed the development of a force field parameter set which has been employed to successfully calculate all crystallographically known structures of 8-12 coordinate lanthanide complexes containing aquo and/or nitrato ligands.

49092 Reactivity of metal dihydrogen complexes: Studies of Mo and W. Van Der Sluys, L.S. (Los Alamos National Laboratory, NM (USA)); Kubas, G.J.; Caulton, K.G. pp. 77, Paper INOR 268 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

Reactivity of the dihydrogen complexes $M(CO)_3(PR_3)_2(H_2)$ [M = Mo or W and R = Cy, ^{i}Pr, Cyp or ^{i}Pr$_2$Cy] will be discussed, including deprotonation with KH and $[CuO^tBu]_4$ and reactions with other substrates. Variable temperature multinuclear NMR and IR data will be presented, and the reactivity compared to that of classical hydride complexes.

49093 Direct measurement of the absolute kinetics of chlorine atom in CCl_4. Chateauneuf, J.E. (Univ. of Notre Dame, IN (USA)). pp. 141, Paper ORGN 450 of American Chemical Society, Division of Organic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

The UV absorption spectrum of chlorine atom in carbon tetrachloride has been measured by nanosecond time-resolved spectroscopy. The absorption band (λ_{max} = 330 nm) of chlorine atom was independently generated and kinetically identified by: pulse radiolysis of CCl_4; 266 nm laser flash photolysis of CCl_4; and 355 nm photodissociation of molecular chlorine in CCl_4. The first directly monitored absolute bimolecular rate constants for the reactions of chlorine atom in CCl_4 are presented. The observed absolute kinetics demonstrate that previous assignments of the radiolytically generated 330 nm band to dichlorocarbene were incorrect.

49094 Strategy and tactics in the search for new harmonic generating crystals. Velsko, S.P. (Lawrence Livermore National Laboratory, CA (USA)). pp. 118, Paper INOR 410 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

Three basic questions must be answered to ensure success in the search for an optimized nonlinear crystal for a particular application: What are the most important optical properties which determine the crystal's figure of merit for the intended application? What is the most efficient methodology for characterizing those optical properties? Where in materials space can crystals with such properties be found with the highest probability? We have answered questions in our program to find improved frequency conversion crystals for high power lasers. The role which chemistry plays in this kind of systematic search will be emphasized. Fundamental issues such as intrinsic limits on nonlinear coefficients and the engineering of nonlinear crystals will also be considered.

49095 Solvent and temperature dependence of the luminescence properties of binuclear metal complexes. Zhang, X. (Brookhaven National Laboratory, Upton, NY (USA)); Sutin, N.; Winkler, J.R. pp. 132, Paper INOR 456 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

The luminescence spectra of a quadruply bonded binuclear molybdenum complex, $Mo_2Cl_4(PMe_3)_4$, have been determined in several solvents at temperatures between 10 and 293 K. The variation of the spectra with solvent polarity and temperature are interpreted using dielectric continuum models. The temporal evolution of the emission spectra has been examined in both fluid and solid nitrile solutions by time-resolved emission spectroscopy (TRES). The results of the TRES studies, in combination with rotational dynamics data from fluorescence depolarization measurements, are used to characterize the dynamics of solvent relaxation about the excited solute.

49096 Emulsion stability and rigid foams from styrene or divinylbenzene water-in-oil emulsions. Williams, J.M. (Los Alamos National Laboratory, NM (USA)); Gray, A.J.; Wilkerson, M.H. *Langmuir (USA)*, 6(2): 437-444 (Feb 1990).

High internal phase emulsions (HIPEs) provide an attractive route to open cell foams. In this paper, we extend our earlier work to include oil phases comprised of 100% styrene or 100% divinylbenzene. In addition, we have evaluated the effects oil-soluble versus water-soluble polymerization initiators, aqueous-phase salt concentrations, and the degree of cross-linking on the microstructure and compressive properties. Foam cell sizes were found to be inversely related surfactant level, relatively insensitive to increases in the monomer levels, but greatly affected by salt concentration. The best textured foams generally had the best formed cells and the most open microstructure.

4004 Electrochemistry

Refer also to citation(s) 48468, 48684, 48692, 48693, 48694, 48695, 48696, 48809, 48840, 50232, 50234

49097 (LBL–26455, pp. 156) **High-energy oxidizers and delocalized-electron solids.** Bartlett, N. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division*

annual report, 1988. Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The main aim of this program is the synthesis and characterization of new materials that may have value in electrochemical applications or in the efficient conversion of light to electrical energy. The synthetic work tests models and theories that correlate physical properties (such as electrical conductivity) with chemical composition and structure. Major aims in the synthetic strategies are (1) to tailor make the band gap in semiconductor materials and (2) to achieve high carrier concentration and mobility in the conductive materials. The present emphasis is on two-dimensional networks, such as those related to graphite. Electron oxidation of such materials (with accompanying intercalation to form salts) generates durable and conductive materials (some conducting better than aluminum). The layered materials can often be oxidized (and intercalated) electrochemically in reversible processes, and some may find use in high-energy electrodes. Physical and chemical studies are being applied to such materials to determine the structure and bonding changes that accompany oxidation and reduction. Salts that are either proton conductors or fluoride-ion conductors, and that are resistant to oxidation but are not metallic, are being sought as solid electrolytes for use with the metallic layer-material salts.

49098 (LBL–26455, pp. 157) **A lithium/C_2F primary battery.** Hagiwara, R.; Lerner, M.; Bartlett, N.; Nakajima, T. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The true graphitic fluoride (sp^2 carbon) C_2F, lithium metal, and a 1M $LiClO_4$-propylene carbonate solution as electrolyte constitute a primary battery. An open-circuit voltage (OCV) of 3.5 to 3.6 V was observed (Li reference) at a discharge depth of 100 to 200 $mAhg^{-1}$. A much faster polarization decay was observed than for the puckered-sheet (sp^3 carbon) carbon fluorides $(CF)_n$ and $(C_2F)_n$. A flat discharge potential of greater than 3 V was observed at a current density of 100 μAcm^{-2}. The discharge capacity above 1 V for 100 μAcm^{-2} current density was approximately 70% of the theoretical capacity of ~600 $mAhg^{-1}$.

49099 (LBL–26455, pp. 157-158) **A general method for the synthesis of polymeric binary fluorides exemplified by AgF_3, NiF_4, RuF_4, and OsF_4.** Zemva, B. (Institute Jozef Stefan, Ljubljana (Yugoslavia)); Lutar, K.; Jesih, A.; Casteel, W.J. Jr.; Bartlett, N. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Fluoride-ion capture from their anion relatives in anhydrous hydrogen fluoride solution by strong fluoride-ion acceptors such as AsF_5 has provided a general approach to the synthesis of polymeric binary fluorides that is particularly advantageous in the synthesis of the highest-oxidation-state transition-metal polymeric fluorides. The highest attainable oxidation state of an element is usually obtained in anionic species. This is commonly so for fluorides; yet, although salts of anions such as NiF_6^{2-} and AgF_4^- have been known for ~ 40 years, neither NiF_4 nor AgF_3 has been established, although a structurally undefined AgF_3 was described recently by Bougon and his coworker. The brown solid NiF_4 loses elemental fluorine above −60°C and has not yet been structurally characterized. AgF_3 precipitated at or below room temperature is a bright red solid that slowly transforms to a dark brown solid of different structure. The freshly precipitated material is isostructural with AuF_3, but the hexagonal unit cell is 27 $Å^3$ smaller than that of its gold relative.

49100 (LBL–26455, pp. 192) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The initiation and growth mechanism of mossy zinc deposits is being investigated in a channel-type flow cell. In situ videomicroscopic observations, scanning electron microscopy, and transmission electron microscopy have shown that moss is generally initiated only after a substantial thickness of compact zinc is deposited, and that it usually forms around a protruding nodule. Over considerable ranges of current densities, zinc deposited from flowing acid electrolytes forms regular striated patterns. Micropatterned electrodes with precisely defined roughness geometry have been prepared in the Berkeley microfabrication facility. These electrodes are being used as substrates in the study of the emergence and development of macroscopic morphological patterns in zinc deposits. Copper deposition from acid electrolyte onto a rotating-disk electrode, in the presence of thiourea, is the vehicle for the study of the role of transport of inhibitors in leveling or brightening. The model developed earlier in this laboratory concerning the role of microscopic flows in the development of surface contour is being adapted to take into account the changing contour during electrodeposition.

49101 (LBL–26455, pp. 193) **Engineering analysis of electrolytic gas evolution.** Tobias, C.W. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Electrolytic gas evolution is among the most common reaction types in electrolysis and in advanced rechargeable batteries. Modern applications in energy storage and transmission (e.g., hydrogen) require much higher energy efficiency and lower capital cost than achieved in gas-generating processes in the past. This project is directed toward the quantitative description of partial processes and their interactions involved in the nucleation, coalescence, and detachment of gas bubbles. Of special interest are the effects of moving individual bubbles and of gas-electrolyte emulsions on ohmic cell resistance and on mass transport of charged and uncharged species to and from electrode surfaces. A thorough understanding of the physical processes involved in the liberation and movement of gases at electrodes and in the electrolyte should lead to improved energy efficiency and lower capital costs in process and device technology.

49102 (LBL–26455, pp. 193-194) **Microscopic resolution of mass-transfer enhancement at vertical gas-evolving electrodes.** Whitney, G.M.; Tobias, C.W. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Mass-transfer enhancement by a stream of bubbles rising near a mass-transfer surface is resolved spatially and temporally, using a micromosaic electrode. The electrode simulates a continuous surface but is composed of electrically isolated elements. The array is surrounded by a larger 5 by 5 mm electrode that ensures that the concentration and electric fields are linear at the segmented area. The effect of hydrogen bubbles rising past the electrode is detected by measuring limiting currents of the reduction of ferric to ferrous sulfate at individual segments of the mosaic electrode. The mass-transfer enhancement by bubble streams rising within the boundary layer is analyzed in terms of a modified surface-renewal theory. It is concluded that the mass transfer due to bubble streams within the boundary layer is aided predominantly by the motion of individual bubbles that disturb the boundary layer, while enhancement caused by bubbles rising outside the boundary layer is the result of an increased velocity gradient at the mass-transfer surface.

49103 (LBL–26455, pp. 197) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

An instrument for the in situ measurement of elastically scattered light from electrode surfaces has been built. Information on surface roughness is derived from the measurements. Light-scattering measurements during the anodic oxidation of Cu showed a very small (200 Å) surface roughness, which slowly increased during growth of the Cu_2O layer, consistent with the formation of a compact film derived from ellipsometer measurements. The early oxidation and reduction of a Cu(111) surface in KOH has been determined by spectroscopic ellipsometry to involve a compact cuprous oxide layer. Light-scattering measurements and scanning tunneling microscopy have confirmed earlier conclusions from ellipsometer observations on the redistribution of silver oxide during the early stages of anodic film formation. The anodic oxidation of nickel, which proceeds by a solid-state diffusion mechanism, has been observed by spectroscopic ellipsometry and a prototype

ellipsometer microprobe. The enhancement of mass transfer by microscopic surface irregularities in a flow field has been investigated by use of electrodes with artificial hillocks and ridges of 5 and 10 μm height, respectively, in a flow field.

49104 (LBL–26455, pp. 198) **The corrosion of carbon black anodes in alkaline electrolyte: IV. Current efficiencies for oxygen evolution from metal oxide-impregnated graphitized furnace blacks.** Staud, N.; Sokol, H.; Ross, P.N. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A quantitative method for determining the number of oxygenated carbon atoms in a carbon black sample was developed and applied to the study of oxygen chemisorption on graphitized furnace blacks. It was found that chemisorption of oxygen atoms produced in a low-pressure microwave discharge of argon/oxygen results in the formation of an oxygen complex on every carbon atom exposed on the edge-plane surface of these carbons. These combined procedures were then used to titrate the surfaces of a variety of graphitized furnace blacks for the number of edge atoms. The corrosion rate of these carbons was found to be directly proportional to the number of sites titrated by oxygen-atom chemisorption, i.e., the number of edge atoms. The number of edge atoms exposed on the surface of graphitized furnace blacks depends on the microstructure of the precursor carbon black and the conditions of graphitization. Catalyzation of these graphitized carbons by NiO has little or no effect on their corrosion rate, which results in current efficiencies for oxygen evolution greater than 98%. The absence of an effect of NiO on the corrosion rate is attributed to the specificity of the corrosion reaction to edge-plane sites and an apparent necessity for contact between NiO particles and edge-plane carbon atoms for catalyzation of the corrosion reaction by NiO. NiO particles sitting on basal planes, which comprise at least 90% of the surface area in these carbons, catalyze only the oxygen-evolution reaction.

49105 (LBL–26455, pp. 198-199) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A new study was initiated last year on modified platinum electrocatalysts for the direct oxidation of methanol in acid electrolyte. This study uses modern surface analytical methods (e.g., low-energy electron diffraction (LEED), Auger electron spectroscopy (AES), x-ray photoelectron spectroscopy (XPS), ion scattering spectroscopy (ISS)) coupled with electrochemical methods to determine the dependence of catalytic activity on the composition and structure of modified platinum surfaces. The best known catalysts for the direct oxidation of methanol are platinum surfaces modified by underpotential deposition (UPD) of certain adatoms, most especially tin. However, virtually all experiments with UPD catalysts were done using the potentiodynamic method, and attempts to translate the enhancement of UPD adatoms to practical electrodes operated at steady state have met with considerable difficulty. The authors have addressed this question initially by preparing a Pt-Sn surface having Sn atoms in known atomic positions, e.g., using Pt-Sn alloy surfaces prepared by UHV. The early results with a Pt_3Sn (100) surface have been very encouraging. LEED and AES analysis indicated that the surface has the composition and structure expected for the bulk truncation at the (100) plane, with the 50% Sn atoms substituting for every other Pt atom in the surface.

49106 (LBL–26455, pp. 158) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Examination of the C_xN products of the chlorination of C_5N at temperatures above 700°C shows that the composition close to the reaction threshold is close to C_6N but that at higher temperatures $(CN)_2$ loss gives sharply lower nitrogen content. There is the possibility that the N atoms of C_5N are not coplanar with the carbon-atom network (which appears to be graphite-like). Electron-energy-loss spectroscopy and the determination of the electronic properties of the C_xN and other B/C and B/C/N graphites are also in hand. To further their understanding of the bonding principles that determine structural type, the synthesis and structural characterization of other unknown binary fluorides is continuing.

49107 (LBL–26455, pp. 200) **Electrical and electrochemical behavior of particulate electrodes.** Evans, J.W. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

This work is concerned with the use of particulate electrodes (especially zinc) in the storage of electrical energy. One of the major difficulties encountered in the use of monolithic (e.g., slablike) zinc electrodes in batteries is the change in the morphology of the electrode as the battery is cycled. For example, there is a tendency for zinc to form nodular or dendritic growths; this growth can have an impact on battery performance by forming shorts or penetrating cell diaphragms. These problems might be overcome by use of a particulate electrode where the zinc is present either as particles or as a thick coating on a particle substrate; the morphology and mechanical integrity of the particle is then of less concern. Possible particulate electrodes are slurry electrodes (where the particles move into and out of the cell suspended in the electrolyte), fluidized-bed electrodes, moving-bed electrodes, and fixed-bed electrodes. Fluidized-bed electrodes have been extensively investigated at LBL and are suitable for charging of the particles (electrodeposition of zinc). However, they appear to be unsuitable for particle discharge (electrodissolution of zinc), and attention has shifted to a different kind of electrode. Laboratory studies with this new cell indicate a performance comparable with that of another zinc-air cell successfully developed at LBL.

49108 (LBL–26455, pp. 200) **Fluid flow and mass transport in small cavities.** Evans, J.W. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Mass transport within small cavities is of technological interest in many practical activities, including battery development. Previous investigators have carried out computations of the effect of fluid flow on this mass transport. Unfortunately, the generality of their results was hidden by their definition of Reynolds and Peclet numbers in terms of a velocity that is inaccessible experimentally, and obtained by calculation only with difficulty. By adopting definitions in terms of a different velocity in the present study, it became possible to recast the results in a way that is more readily used by both theoreticians and experimentalists.

49109 (LBL–26455, pp. 200) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The novel zinc-air cell, which has shown good discharge performance in laboratory studies, is undergoing further development.

49110 (LBL–26455, pp. 201) **Electrochemical properties of solid electrolytes.** De Jonghe, L.C. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The goals of this research program include the definition of key factors governing the high- and intermediate-temperature performance and reliability of sodium β''-alumina electrolytes, the investigation of intermediate- and ambient-temperature alkali metal/organosulfur batteries, and fundamental electrochemical studies of the properties of organosulfur redox couples. Probably the best known and most extensively research solid electrolyte is sodium β''-alumina; the chemical, electrochemical, and mechanical properties of this ceramic have been evaluated, both ex situ and in situ, as the separator in sodium/sulfur cells. In fact, the sodium/β''-alumina/sulfur battery, which operates at 350°C, has already achieved high energy and power density, long cycle life, and high reliability. Still, the impressive performance of these cells is offset somewhat by the technical difficulties of operating batteries at high temperatures.

49111 (LBL–26455, pp. 201-202) **Chemical stability of sodium beta''-alumina electrolyte in sulfur/sodium polysulfide**

melts. Liu, M.; De Jonghe, L.C. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Degradation of the electrolyte separator in the Na/β''-alumina/Na_2S_x battery is one of the major limitations determining cell reliability and useful life. There has been considerable effort in establishing the mechanism of degradation of the electrolyte in contact with the negative molten sodium electrode. In the present investigation, β''-alumina samples were exposed to polysulfide metals of varying composition (from Na_2S_2 to Na_2S_5 to pure sulfur) with and without impurity contamination for a period of 5 to 10 weeks, and the resulting corroded electrolytes were examined by Auger electron spectroscopy and electron microscopy techniques. The impurities introduced to the melts included water, moist air, oxygen, Na/S battery case material, and carbon felt. Examination of the deteriorated electrolytes led to the conclusion that β''-alumina ceramics were indeed chemically attacked by Na_2S_x melts and pure sulfur at high temperatures. The likely thermodynamic reactions for corrosion of these electrolytes were written for each set of conditions encountered in the tests. The thermodynamically stable corrosion products are Na_2SO_4, $NaAl(SO_4)_2$, $Al_2(SO_4)_3$, $NaHSO_4$, Na_2CO_3, and NaOH. The degree of corrosion of the electrolytes was found to increase with content of sulfur in the melt in going from Na_2S_x to pure sulfur. Furthermore, all of the corrosion reactions were greatly accelerated by the presence of impurities such as water, oxygen, and transition metals contained in cell casement alloys.

49112 (LBL–26455, pp. 202-203) **Sodium/beta''-alumina/organosulfur batteries operating at intermediate temperatures.** Visco, S.J.; De Jonghe, L.C. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Sodium-beta''-alumina solid electrolyte is particularly well suited to intermediate-temperature applications, due to both its high ionic conductivity and low activation energy for conduction. The current study highlights Na/β''/organosulfur cells operating in the temperature range of 100 to 130°C. The organosulfur electrodes are based on the reversible redox dimerization of thio anions to disulfides, $RSSR + 2e^- = 2\ RS^-$, where R is an organic moiety. The general cell reaction for a sodium-based cell using these positive electrodes is 2 Na + RSSR = 2 NaRS. All the disulfide electrodes tested to date have been liquid at the cell operating temperature, but only a few of the thiolate salts have been molten at these temperatures. Consequently, the sodium thiolate salts must either be soluble in the parent disulfide up to a saturation limit, or an appropriate solvent must be included in the positive electrode to facilitate complete discharge of the cell. The current study highlights Na/RSSR cells having ethereal or hydroxy-based organosulfur electrodes. Sodium/β''/hydroxyethyl disulfide cells were discharged at high rates at 120°C without the aid of solvents or other additives.

49113 (LBL–26455, pp. 203-204) **Electrochemical investigations of organodisulfide/thiolate redox couples.** Liu, M.; Visco, S.J.; De Jonghe, L.C. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The redox behavior, kinetic reversibility, chemical reversibility and stability, and specific adsorption or chemisorption at various electrode interfaces was investigated for a homologous group of organosulfur compounds, including tetraethyl thiuram disulfide (TETD), tetramethyl thiuram disulfide (TMTD), phenyl disulfide (PDS), and fluorophenyl disulfide (FPDS), dissolved in appropriate nonaqueous solvents. Although a few cursory electrochemical experiments had been reported for thio/disulfide redox couples in nonaqueous solvents, neither the overall redox reaction nor the detailed redox mechanism for this couple had been established prior to this study. Results from chronoamperometry and/or chronocoulometry studies were combined with data obtained from rotating-disk-electrode studies to establish the number of electrons transferred in the overall redox reaction as well as the diffusion coefficients of the various electroactive materials. The culmination of the data indicated that the overall, stoichiometric reaction of these redox couples is $RSSR + 2\ e^- = 2\ RS^-$, where R represents an organic moiety.

49114 (LBL–26455, pp. 204) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Electrical and mechanical properties of sodium beta''-alumina electrolytes are being studied as a function of ceramic-processing conditions and dopant levels in order to optimize the polycrystalline Na^+ conductors for use at intermediate temperatures (100 to 250°C). Optimized electrolytes are targeted for a variety of intermediate-temperature cells, including the Na/β''/RSSR batteries, which operate in the range of 100 to 150°C.

49115 (LBL–26455, pp. 205) **Analysis and simulation of electrochemical systems.** Newman, J. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

This program involves fundamental investigations of the transport and interfacial phenomena important in electrochemical systems. Results of this work are used to analyze experimental data, to identify important system parameters, and to aid in the design and scale-up of electrochemical systems. Specific projects include the analysis of transient and steady-state transport processes in solid polymer electrolytes, mathematical modeling of the Li-Al/FeS, the Li-Al/FeS_2, and the Na/$FeCl_2$ batteries, theoretical investigations of inductance effects in high-power batteries, an investigation of the ac impedance behavior of porous electrodes, and the rigorous interpretation of cyclic voltammetry and ac impedance experiments.

49116 (LBL–26455, pp. 205) **Current distribution near an electrode edge as a primary distribution is approached.** West, A.C.; Newman, J. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

When ohmic resistances dominate over electrode kinetic resistances, the distribution of current density on an electrode can be highly nonuniform. In the limit of zero kinetic resistance (i.e., a primary current distribution), the current density at the edge of an electrode will be infinite if the interior angle of intersection between the electrode and insulator is obtuse. In practical cases, nonzero kinetic resistances exist, and the current density remains finite. Previous results demonstrate that, when the ohmic resistance is large compared to the kinetic resistance, the current distribution can be described by the primary distribution everywhere except the edge region. The purpose of this paper is to describe the deviations from the primary distribution and to show explicitly the manner in which the current density at the edge of the electrode approaches extreme values as the ohmic resistance becomes large. The analysis is valid for any angle of intersection and can be applied in the edge region (for a large ohmic resistance) regardless of the geometric details of the rest of the electrochemical cell. Results are given for linear and Tafel kinetics.

49117 (LBL–26455, pp. 205) **Modeling and optimization of Li-alloy/metal-sulfide molten-salt batteries.** Mason, A.A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

An optimization of Li-Al/FeS_x molten-salt batteries is presented. The computer model uses input data from experimental test cells and is valid for prismatic cell geometries. Emphasis is placed on the negative-to-positive capacity ratio and the number of electrodes per cell. The Li-Al/FeS, Li-Al/FeS_2 (two-plateau operation), and Li-Al/FeS_2 (upper-plateau operation) battery systems are compared. While the specific energies are similar for all three systems, the specific power near the end of discharge is highest for the upper-plateau FeS_2 system. A similar model for a multielectrode Li-Al/FeS_2 cylindrical cell (upper-plateau operation) is also presented. The effects of the positive-current collector radius, the cell height, and the number of positive electrodes on the specific energy and specific power are examined. Sufficient experimental data are not

present for this geometry, so detailed conclusions are difficult to draw.

49118 (LBL–26455, pp. 205) **Determination of the diffusion coefficient from impedance data in the low-frequency range.** Tribollet, B.; Smyrl, W.H.; Newman, J. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A new method is given for determining the diffusion coefficient or the Schmidt number of an electroactive species. The variation of the real part, relative to the imaginary part, of the electrochemical impedance, or of the electrohydrodynamic (EHD) impedance, at a rotating disk yields the diffusion coefficient without any assumption about the kinetics or any specific values for the electrode area or the solution concentration. This method may be used for all ordinary Schmidt number values (greater than 100).

49119 (LBL–26455, pp. 206) **Transference number calculations for sodium polysulfides.** Risch, T.; Newman, J. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Transference numbers for sodium cations and sulfur anions in sodium polysulfide melts are calculated from previously determined experimental data. Concentrated electrolyte theory, assuming a binary electrolyte consisting of sodium anions and sulfide cations in a neutral sulfur solvent, is used to relate the transference numbers to fundamental solution transport properties. Slopes of open-circuit potential measurements vs melt composition on sodium-sulfur cells with and without transference are used to determine the sulfur anion and sodium cation transference numbers. The transference number of sodium cations is calculated from previous experimental data for two temperatures, 573 and 633 K, and range from 0.88 to 0.93 for sodium sulfide mole fractions between 0.20 and 0.34. These values for transference numbers presented here are more accurate than previous interpretations of these data where unity sodium cation transference numbers were assumed. The results of this work are shown to be important in the design of sodium-sulfur cells.

49120 (LBL–26455, pp. 206) **The effect of Schmidt number on the Faradaic impedance.** Hauser, A.K.; Newman, J. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Frequency-response analysis results calculated by a Stefan-Maxwell impedance model are presented for a copper rotating disk in chloride solutions. The algorithm accounts for multicomponent diffusion, migration, and homogeneous and heterogeneous reactions, as well as a finite Schmidt number and interfacial velocity. The validity of the model was checked by comparing its results with analytic solutions valid in the limit of dilute solutions, excess supporting electrolyte, and infinite Schmidt number. Good agreement was obtained. Results for copper dissolution are plotted in various forms, enabling easier interpretation of the system. The effect of the Schmidt number on the faradaic impedance has been examined, and an alternative way of plotting the dimensionless convective-diffusion impedance is proposed to reduce the Schmidt number dependence of the frequency response nearly to one curve by stretching the abscissa using $(\omega/\Omega)Sc^{1/3}$.

49121 (LBL–26455, pp. 223) **Origin of high T_c.** Kresin, V.Z.; Morawitz, H. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The observed high superconducting transition temperatures are caused, in their view, by the coexistence of strong electron-phonon coupling and the plasmon mechanism. A generalized Eliashberg equation describing the effects of phonons and plasmons on the pairing is presented. Their approach is based on the method of thermodynamic Green's functions. The structure of the plasmon and phonon bands in conducting, highly anisotropic layered materials is studied.

49122 (LBL–26455, pp. 223) **Major parameters of the high-T_c oxides.** Kresin, V.Z.; Deutscher, G.; Wolf, S.A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A general fundamental feature of the high-T_c oxides is a very small value of the Fermi energy. The authors point out that this leads to peculiar thermodynamic and transport properties in the normal and superconductive states, which in fact require unconventional analysis. They show that the electronic heat capacity can be separated at high temperature, and it can be used to determine the electron-phonon coupling constant. The unusual temperature dependences of the kinetic coefficients can also be explained.

49123 **SAW gas sensors based on acoustoelectric effects.** Ricco, A.J. (Sandia National Laboratories, Albuquerque, NM (USA)); Martin, S.J. pp. 20, Paper ANYL 65 of American Chemical Society, Division of Analytical Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

Acoustoelectric coupling between surface acoustic waves (SAWs) and conductive thin films has been examined as a basis for gas phase chemical sensors and as a means to study thin film conductivity effects in general. When a SAW propagates along the surface of a piezoelectric substrate, the electric field which accompanies the mechanical wave can interact with charge carriers in a thin film on the device surface. This interaction perturbs SAW propagation characteristics, in particular acoustic wave velocity and attenuation, providing a sensor response which in some cases is many times larger than the response from surface mass changes alone. We have utilized SAW devices to monitor the sheet conductivity of thin metal and organometallic conductor films during their deposition and during subsequent chemisorption of small molecules.

4005 Photochemistry

Refer also to citation(s) 48940, 48961, 48962, 48963, 48983, 48999, 49000, 49035, 49039, 49040, 49047, 49048, 49049, 49054, 49097, 49155, 49321, 49564, 49886

49124 (DOE/ER/13808–T1) **Intramolecular electron transfer rates: Three year progress report.** Hupp, J.T. Northwestern Univ., Chicago, IL (USA). [1990]. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER13808. Order Number DE90017447. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The initial goals of this project were: (1) to construct pulsed-accelerated-flow and pulsed-laser (transient absorbance) instruments for intramolecular electron-transfer rate measurements, (2) to design and synthesize appropriate molecules and perform such measurements, (3) to develop further an electrochemical method for gauging site-to-site electronic coupling, and (4) to apply time-dependent Raman scattering theory to the problem of inner-shell reorganization in charge-transfer reactions. Although all four goals were met, we also found it necessary to pursue studies in some unforeseen directions. For example, early on we discovered that medium effects (aggregation and ion pairing) could play a very large, and previously unrecognized, role in some optical intervalence reactions. Given the importance of the effects to the areas above, we chose to map them in a fairly complete fashion. Also, in anticipation of possible renewal we initiated studies in a new area: bimolecular photoredox kinetics in supercritical media. Finally, in a small project carried out largely by undergraduates we examined solvent tuning effects upon lifetimes of photo-excited ruthenium am(m)ine bipyridine complexes. The key new findings and other highlights of these studies are outlined.

49125 (LBL–26455, pp. 117) **Energy transfer and structural studies of molecules on surfaces.** Harris, C.B. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The goal of this research is to study the mechanisms that are responsible for the transfer of energy from the excited states of molecules to metal surfaces and to develop new laser techniques

for probing molecule-surface interactions. The research program is both theoretical and experimental in character, and it includes nonlinear optical, picosecond, and femtosecond laser techniques, in addition to a variety of standard surface-science tools for characterizing molecule-surface interactions. Recent work has centered on the development of picosecond infrared lasers; the elucidation of the mechanisms of surface-enhanced photochemistry, surface-enhanced photoelectron emission, and the breakdown of classical dielectric response theory for explaining energy transfer from molecules to noble metal surfaces; and the development of new techniques for studying the dynamics of electrons at interfaces on femtosecond time-scales. The results of this program have a direct bearing on high-speed technological devices and materials, and on other problems of general interest such as the dynamics of electrical transmission in conductors on ultrafast timescales and the optical properties of thin films.

49126 (LBL–26455, pp. 120) **Selective photochemistry.** Moore, C.B. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The fundamental goals of this program are to understand the photophysics and photochemistry that occur following selective excitation of molecules and during the reactions of free radicals. Of particular interest are the chemical reactions of specifically excited states and the dynamics of energy transfer, both within a molecule and to surrounding molecules. Molecules produced in bound excited singlet states may fragment following the conversion of electronic excitation energy into vibrational energy. In this work the dynamics of intersystem crossing and reaction of the triplet state are studied for both unimolecular and bimolecular systems. For low levels of vibrational excitation in small molecules, individual quantum states may be excited, enabling the measurement of reaction and energy-transfer rate constants for each quantum state. For larger or more highly excited molecules, it is usually not possible to excite single eigenstates. Instead, a number of eigenstates are excited simultaneously, and a redistribution of the initial vibrational excitation occurs. The rates and mechanisms of free-radical reactions, such as are important in combustion, are often best studied by flash kinetic spectroscopy using lasers for thermal heating, for photolyzing, and for spectroscopic probing. A fundamental understanding of the rate constants and product distributions for these reactions is sought to serve as a basis for modeling combustion processes.

49127 (LBL–26455, pp. 121) **Hydrogen-atom tunneling in the thermal tautomerism of porphine imbedded in a n-hexane matrix.** Butenhoff, T.J.; Moore, C.B. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Rate constants and the kinetic isotope effect for the tautomerization of porphine, imbedded in a n-hexane Shpol'skii matrix near 110 K have been measured using laser-induced fluorescence spectroscopy. A one-dimensional tunneling-model calculation has been used to compare the feasibility of the synchronous and asynchronous hydrogen-migration mechanisms. Only the asynchronous tunneling model is consistent with the rate constants and kinetic-isotope effects measured near 110 K and near room temperature. This work provides the reaction mechanism and potential-surface data needed for a study of mode selectivity in infrared photochemistry.

49128 (LBL–26455, pp. 121-122) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Energy transfer and chemical reaction rates are being studied for HCO and triplet CH_2 radicals. A diode laser infrared flash kinetic spectrometer has been constructed to extend this work beyond the 2-4 μm range available with the authors current difference-frequency spectrometer. Reaction rates of $^3CH_2$ with O_2 and NO have already been measured in collaboration with H.S. Johnston. Reaction rates for radical-radical reactions are being measured. Studies of reaction product distributions and formation kinetics are planned for the near future. Spectroscopy of radical-radical and radical-molecule reaction complexes is planned. Unimolecular reaction dynamics are being studied by photofragment spectroscopy. A molecular-beam system has been constructed to use with the new VUV laser system developed together with Y.T. Lee and A.H. Kung. The fragmentation of ketene on its triplet potential energy surface will be studied by detection of CO using a tunable photolysis laser below the threshold for singlet fragmentation. Infrared spectra of intermediates in organometallic photochemistry in gas and liquid phase are being studied jointly with R.G. Bergman. Emphasis is on CH activation chemistry. The work reported above has shifted to studies of CH activation systems studied in liquid Kr and Xe.

49129 (LBL–26455, pp. 123) **Physical chemistry with emphasis on thermodynamic properties.** Pitzer, K.S. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The purpose of this program is the discovery and development of methods of calculation of thermodynamic and related properties of important chemical systems by the use of quantum and statistical mechanics together with experimental measurements for key systems. Current emphasis is on novel ionic systems and on properties close to the critical point. Systems comprising fused salts mixed in any proportion with water or other polar solvents are being studied experimentally and with theory. Current studies also include (1) dilute ionic solutions very close to the critical point of the solvent where anomalous properties are observed and (2) the representation of near-critical properties in an equation of state valid over the full range of temperature and density. Recent theoretical advances include treatments of the dielectric constant of H_2O, the thermodynamics of ionic solutions in H_2O above its critical temperature, and the critical properties of pure ionic fluids such as NaCl. Earlier advances yielded improved equations for electrolyte solutions. These various equations are now being applied to a wide variety of systems of industrial or geological interest, including geothermal brines. Other recent research involved the relativistic quantum chemistry of molecules containing very heavy atoms.

49130 (LBL–26455, pp. 136) **Photoelectron spectroscopy.** Shirley, D.A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

This program addresses both experimental and theoretical aspects of electron spectroscopy for the investigation of electronic structure of matter in the gaseous and condensed phases. Research is conducted using both laboratory sources at LBL and synchrotron radiation in the 5-5,000 eV energy range available at the Stanford Synchrotron Radiation Laboratory, where there is participation in developing the spectroscopy of this newly accessible range of the electromagnetic spectrum. Time-of-flight measurements with synchrotron radiation are used to measure angular distributions of photoelectrons and resonant photoemission phenomena in the gas phase. Ultrahigh-resolution photoelectron spectroscopy based on molecular beams is yielding new information about small molecules and about the transition from single metal atoms to behavior characteristic of a three-dimensional solid. Employing angle-resolved, variable-energy photoemission and electro-energy-loss spectroscopy, this program examines the electronic structure of solids. The program also studies the geometric and electronic structure of surface-adsorbate systems using photoelectron diffraction, angle-resolved photoemission extended fine structure (ARPEFS), and surface extended x-ray absorption fine structure (SEXAFS).

49131 (LBL–26455, pp. 136) **Observation of correlation effects in zero kinetic energy electron spectra near the N1s and C1s thresholds in N_2, CO, C_6H_6, and C_2H_4.** Medhurst, L.J.; Ferrett, T.A.; Heimann, P.A.; Lindle, D.W.; Liu, S.H.; Shirley, D.A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Zero kinetic energy (ZKE) spectra of N_2, CO, C_2H_4, and C_6H_6 were taken across the N1s (N_2) and C1s ionization thresholds. Discrete resonances at subthreshold photon energies were observed and were found to become more intense as threshold is approached relative to the same peaks in absorption spectra. For N_2

the satellite/main-line branching ratios at threshold are 11(1)% for the 419.7(1) eV binding energy satellite, and 2.3(1.0)% for the 426.5(1) eV binding energy satellite. For CO, the branching ratio for the 304.6(1) eV binding energy satellite is 15(2)% at its threshold. Branching ratios at threshold are also determined for the satellites of C_6H_6 and C_2H_4. Decay characteristics and assignments of the continuum features of C_6H_6 and C_2H_4 are also discussed.

49132 (LBL–26455, pp. 137) **Angle-resolved photoemission from the Ar 2p subshell.** Lindle, D.W.; Medhurst, L.J.; Ferrett, T.A.; Heimann, P.A.; Piancastelli, M.N.; Liu, S.H.; Shirley, D.A.; Carlson, T.A.; Deshmukh, P.C.; Nasreen, G.; Manson, S.T. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The angular distribution for Ar 2p photoionization has been measured from just above threshold to 400 eV photon energy and calculated in the same energy range using the relativistic random-phase approximation. The present experimental and theoretical results are in good agreement but disagree somewhat with earlier Hartree-Fock (HF) calculations. The HF values are found to be significantly higher in the near-threshold region. Possible reasons for this discrepancy are discussed with relevance to the general understanding of inner-shell photoionization phenomena.

49133 (LBL–26455, pp. 137-138) **Resonant processes above the carbon 1s ionization threshold in benzene and ethylene.** Piancastelli, M.N.; Ferrett, T.A.; Lindle, D.W.; Medhurst, L.J.; Heimann, P.A.; Liu, S.H.; Shirley, D.A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Resonant photoemission has been studied above the carbon 1s ionization thresholds in gas-phase benzene and ethylene. The experimental data for both molecules include relative partial cross-section and asymmetry-parameter measurements for the C1s main line and asymmetry-parameter measurements for one C1s shake-up satellite in each system. Resonances above the C K-edge have been analyzed on the basis of the their decay to either the C1s main-line or valence-hole states, and have been tentatively assigned as either shape resonances or doubly excited states according to their observed one-electron or man-electron decay, respectively. The importance of determining the resonant behavior of all available photoemission channels in the proximity of a resonance is thus illustrated.

49134 (LBL–26455, pp. 138) **Adsorption and surface reactions of H_2S and SO_2 on Cu(100) studied by electron-energy-loss spectroscopy.** Leung, K.T.; Zhang, X.S.; Shirley, D.A. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The adsorption of H_2S and SO_2 on Cu(100) was investigated using electron-energy-loss spectroscopy as a function of coverage, temperature, and scattering angles. In particular, irreversible dissociation of H_2S and the formation of sulfhydryl (SH) species at low and intermediate coverage on Cu(100) were observed at low temperature. This was followed by molecular physisorption at higher coverage. In the case of SO_2 on Cu(100), decomposition of SO_2 and the formation of SO_3 surface species at room temperature were observed. A surface reaction involving preadsorbed SO_2 on Cu(100) with H_2SD is discussed.

49135 (LBL–26455, pp. 141) **High-resolution photoionization spectrum of water molecules in a supersonic beam.** Page, R.H.; Larkin, R.J.; Shen, Y.R.; Lee, Y.T. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The authors have obtained high-resolution ($\sim$ 1.5 cm^{-1}) photoionization spectra of supersonically cooled ($T_{rot} \sim$ 50K) H_2O and D_2O in the 1,000-900 Å range. The light source, generated by frequency tripling in a pulsed free jet of gas, is described briefly. Spectra are rotationally resolved. Vibrationally excited autoionizing Rydberg series converging to the ground electronic state [X; $(1b_1)^{-1}$] of the molecular ion are detected. This may well be the first example of a highly resolved Rydberg spectrum of a stable polyatomic molecule. From the convergence limit, the ionization potential H_2O is determined to be 101, 777 $\pm$ 7 cm^{-1}. Rydberg-state lifetimes are $\sim$ 1 psec, deduced from homogeneous linewidths. Autoionizing features from Rydberg states associated with the ion's quasilinear A $(3a_1)^{-1}$ state are observed with linewidths greater than 10 cm^{-1}. Rotational assignments of some of the bands in this linear $\leftarrow$ bent transition show that the Rydberg- and ionic-state geometries are nearly identical. A consistent assignment of the controversial bending (v_2) quantum number and Rydberg-series quantum defect $\delta \approx -0.037$ have been provided.

49136 (LBL–26455, pp. 141) **Tunable far-infrared laser spectroscopy of van der Waals bonds: Extended measurements on the lowest Σ bend of ArHCl.** Busarow, K.L.; Blake, G.A.; Laughlin, K.B.; Cohen, R.C.; Lee, Y.T.; Saykally, R.J. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A tunable far-infrared laser system has been used to measure the vibration-rotation spectrum of the lowest Σ bending state of ArHCl near 24 cm^{-1} in a continuous-wave planar jet operating with a terminal-jet temperature near 3 K. Over 60 transitions have been observed for both ^{35}Cl and ^{37}Cl isotopes with resolution of the quadrupole hyperfine structure. An improved set of molecular parameters was determined, including B, D, H, and eqQ for both upper and lower states. Very narrow linewidths (approximately 300 kHz) resulting in high resolution and sensitivity make this technique a powerful new method for the detailed investigation of intermolecular forces.

49137 (LBL–26455, pp. 142) **Symmetric stretch excitation of CH_3 in the 193.3-nm photolysis of CH_3I.** Continetti, R.E.; Balko, B.A.; Lee, Y.T. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

New high-resolution photofragment translational-spectroscopy measurements on the 193.3-nm photolysis of CH_3I reveal up to four quanta of v_1 C-H symmetric stretch excitation in the C-I bond-fission channel. In addition, these experiments show for the first time that C-H bond fission occurs at wavelengths longer than 185 nm with a quantum yield of $\sim$ 3%. The data yield upper bounds to the C-H bond-dissociation energy in CH_3I of 101 $\pm$ 1 kcal/mol and, for the C-I bond-dissociation energy, 55.0 $\pm$ 0.3 kcal/mol.

49138 (LBL–26455, pp. 142) **The reactions of ground- and excited-state sodium atoms with hydrogen halide molecules.** Weiss, P.S.; Mestdagh, J.M.; Covinsky, M.H.; Balko, B.A.; Lee, Y.T. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The reactions of ground- and excited-state Na atoms with hydrogen halide (HX) molecules have been studied using the crossed-molecular-beams method. With both increasing translational and increasing electronic energy, the reactive cross sections increase in the reactions of HCl and HBr. From product angular and velocity distributions, detailed center-of-mass information is derived. For the reactions of Na, 5 $^2S_{1/2}$ with HCl, the product NaCl is backscattered with respect to the incoming Na atom in the center-of-mass frame of reference. The reaction of each Na state studied with HCl is direct and proceeds via collinear and near-collinear Na-Cl-H approach geometries. For the Na(3 $^2P_{3/2}$) and Na(4 $^2D_{5/2}$) reactions with HCl, the predominant transition-state symmetry is $^2\Sigma$ in a collinear ($C_{\infty v}$) Na-Cl-H geometry. This is consistent with the reaction proceeding via electron transfer from the Na atom to the halide atom. Absolute reactive cross sections for each state of Na studied with HCl were determined by comparison with both small- and large-angle elastic scattering. The authors were unable to observe Na atoms with over 4 eV of electronic energy react with HF up to collision energies of 13 kcal/mol.

49139 (LBL–26455, pp. 142) **Tunable far-infrared laser spectroscopy of van der Waals bonds: Vibration-rotation-tunneling spectra of Ar-H_2O.** Cohen, R.C.; Busarow, K.L.; Laughlin, K.B.; Blake, G.A.; Havenith, M.; Lee, Y.T.; Saykally, R.J.

Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The first high-resolution spectra of a rare gas-H_2O cluster have been observed using a tunable far-infrared laser to probe the vibration-rotation-tunneling levels of Ar-H_2O formed in a continuous planar supersonic jet. The high sensitivity of this spectrometer facilitated extensive measurements of two perpendicular subbands assigned to transitions from the ground state to the upper component of a hydrogen-exchange tunneling doublet (c-type) at 21 cm^{-1}, and $\nu_{b1} = 1^+$ (b-type) at 25 cm^{-1}, the lower tunneling component of a bending vibration that is perpendicular to the tunneling coordinate. The tunneling splitting is shown to be in the range 2.5-7 cm^{-1}, and the lower tunneling component of the excited bending vibration lies between 39 and 43 cm^{-1} above the ground state of the complex. The experimentally determined center-of-mass separation ($R_{c.m.}$ = 3.75 Å) and harmonic-stretching force constant (k_s = 0.0134 mdyn/Å) are compared to those of related first- and second-row hydrides. The large-amplitude motions occurring within this complex make it difficult to establish its structure.

49140 (LBL–26455, pp. 144) **Ultranarrow-bandwidth vacuum ultraviolet (VUV)-XUV laser system.** Cromwell, E.; Trickl, T.; Lee, Y.T.; Kung, A.H. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

An ultrahigh-brightness laser system has been developed to study the spectroscopy and dynamics of molecules and clusters in the VUV-XUV spectral region. The laser utilizes pulse amplification of a single-mode ring dye laser, frequency doubling, and four-wave mixing in a pulsed jet. Pulse energies of > 100 mJ in the visible and > 10^{11} photons/pulse in the VUV-XUV have been obtained. The bandwidth of the laser has been measured to be 91 MHz in the visible and 210 MHz in the XUV.

49141 (LBL–26455, pp. 144) **Dissociation of cyclohexene and 1,4-cyclohexadiene in a molecular beam.** Zhao, X.; Continetti, R.E.; Yokoyama, A.; Hintsa, E.J.; Lee, Y.T. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Molecular-beam photofragmentation translational spectroscopy of cyclohexene and 1,4-cyclohexadiene was carried out using 193-nm and IR multiphoton excitation. At 193 nm, both the retro-Diels-Alder reaction of cyclohexene and H_2 elimination from both molecules were observed in the ground electronic state, indicating the occurrence of internal conversion of the electronically excited states. The retro-Diels-Alder reaction is shown to be concerted up to an internal energy higher than 148 kcal/mol. H-atom elimination was also observed for both molecules following 193-nm excitation. The H atom is eliminated from an excited state of cyclohexene and is assigned to be from a carbon next to the double bond with a corresponding C-H bond energy of 87 ± 3 kcal/mol. It is shown that the peak of the translational-energy distribution for concerted dissociation in the ground state is determined mainly by the dynamics of the potential-energy release along the reaction coordinate and is not sensitive to either the amount of internal energy or the form of excitation.

49142 (LBL–26455, pp. 144-146) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Upon the completion of the investigation of the dynamics of D + H_2 → DH + H reaction, a series of substitution reactions of D atoms and unsaturated hydrocarbons will be carried out. Among the first reactions to be investigated are D + C_2H_2 → C_2HD + H and the possible ring-opening reaction of benzene induced by the addition of energetic D atoms. The reactions of electronically excited Ba atoms and transition-metal atoms with oxygen-containing molecules are also under preparation. The production and dissociation of polyatomic radicals will be one of their major themes. Of particular interest is the CH_2CH_2OH radical, which is the intermediate of $\cdot C_2H_4$ + OH product reaction and can be produced from the photodissociation of Br × CH_2CH_2OH using 193-nm photons. Secondary dissociation of vibrationally excited $\cdot CCH_2CH_2OH$ radicals will be investigated using molecular-beam photofragmentation translational spectroscopy. The other important area that will be intensely investigated is the systematic survey of the dynamics and mechanisms of primary dissociation processes of unsaturated hydrocarbons. The solvation of NH_4^+ and H_3O^+ by NH_3 and H_2O will be investigated through the measurements of infrared absorption spectra. The investigation will cover the first and second solvation shells and will then move on to solvated metal ions such as $Na^+(H_2O)_n$.

49143 Light induced processes of MLCT [metal to ligand charge transfer] excited states attached to a soluble polymer. Worl, L.A. (Los Alamos National Laboratories, NM (USA)); Danielson, E.; Strouse, G.F.; Younathan, J.; Meyer, T.J. pp. 35, Paper INOR 116 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

Soluble polymers have been prepared which contain high loadings of metal to ligand charge transfer (MLCT) visible light absorbers based on polypyridyl complexes of Ru^{II} or Os^{II}. The complexes have been attached to a polystyrene/chloromethylpolystyrene copolymer, and by using excesses of the complexes complete substitution at the available ~30 chloromethyl sites can be achieved. A series of mixed-valence polymers with controlled M^{II}/M^{III} ratios has been prepared. The photochemical and photophysical properties of the chromophoric polymeric systems will be presented.

49144 Enhanced photooxidation of anthracene on SiO_2. Zingg, S.P. (Oak Ridge National Laboratory, TN (USA)); Pagni, R.M.; Dworkin, A.S. pp. 120, Paper ORGN 380 of American Chemical Society, Division of Organic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

The phototransformations of organics are strongly mediated by their sorption to solids. Anthracene was chosen as a substrate in our investigation of the effects of surface sorption on phototransformations because of the abundance of literature on its solution photochemistry. Anthracene undergoes a variety of photochemical reactions including energy transfer, electron transfer, photooxygenation and photodimerization. We have observed a greatly enhanced rate of photooxygenation of anthracene when sorbed on SiO_2 in cyclohexane/SiO_2 slurries. Factors which may influence the rate of photooxygenation of anthracene sorbed on SiO_2 as well as in solution will be discussed. These factors include increased irradiance due to light scattering by SiO_2, the role of the more polar environment of the SiO_2 surface, the role of solution and sorbed O_2, and surface coverage.

4006 Radiation Chemistry

Refer also to citation(s) 48406, 48960

49145 (LBL–26455, pp. 127) **Molecular interactions.** Lester, W.A. Jr. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

This research program is directed at extending fundamental knowledge of atoms and molecules including their electronic structure, mutual interaction, collision dynamics, and interaction with radiation. The approach combines the use of ab initio methods - multiconfiguration Hartree-Fock (MCHF), configuration interaction (CI), and the recently developed quantum Monte Carlo (QMC) - to describe electronic structure, intermolecular interactions, and other properties, with various methods for characterizing inelastic and reactive collision processes, and photodissociation dynamics.

49146 Electron irradiation of poly(tetrafluoroethylene): Effect on adhesion and comparison with X-rays. Rye, R.R. (Sandia National Laboratories, Albuquerque, NM (USA)). *Langmuir (USA),* 6(2): 338-344 (Feb 1990).

Electron irradiation of poly(tetrafluoroethylene) (PTFE) at energies from 0.5 to 3.0 keV is shown to protect against chemical etching used to prepare the surface for bonding. This etching

protection is interpreted in terms of known radiation-induced cross-linking and/or branching. For a 2-keV electron dose of ≈5 $\mu A \cdot s/cm^2$, the adhesion strength to epoxy, after etching, is reduced to less than 3% of the nonirradiated value. The effect of the different depth distributions on both adhesion and desorption is discussed.

4007 Radiochemistry and Nuclear Chemistry

Refer also to citation(s) 48223, 48284, 48361, 48636, 49329, 49869

49147 (BARC–1473) **Radiochemistry Division: annual progress report: 1987.** Bhabha Atomic Research Centre, Bombay (India). 1989. 221p. Order Number DE91601427. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The progress of Research and Development (R and D) activities during the year 1987 are reported in the form of summaries, which are presented under the headings (1) Actinide Chemistry, (2) Nuclear Chemistry, and (3) Spectroscopy. Microwave absorption studies of the high Tsub(c) oxide superconductor $YBa_2Cu_3Osub(7-x)$ using electron paramagnetic resonance techniques are the new feature during the report year. Radioanalytical services and radiation sources in the form of electrodeposited sources or standard soluti ons were also given to the other Divisions, other units of the Department of Atomic Energy, and other organisations in the country. A list of papers by the members of the Division published in various journals and presented at various symposia, conferences etc. is given at the end of the report. (M.G.B.). refs., 51 tabs., 33 figs.

49148 (IPEN-PUB–286) **Miniaturized chromatographic radiochemical procedure for ^{131}I - MIBG.** Barboza, M.F. de; Pereira, N.S. de; Colturato, M.T.; Silva, C.P.G. da. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Dec 1989. 12p. Order Number DE91601444. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Different solvents were used in paper chromatographic methods to obtain the best system in routine radiochemical control for ^{131}I-MIBG produced at IPEN-CNEN/SP. The dates were compared with those obtained with eletrophoresis method in buffer acetate, pH=4.5, 350V, during 40 minutes. The stability of the labeled compound store under 4^0C was studied during 15 days. Miniaturized chromatographic procedures were established using Whatman 3MM (8x1cm) and n-butanol-:acetic acid: water (S:2:1) as a solvent. the Rf values were: 0.3 (I^-) and 1.0 (MIBG). The radiochemical purity was 99.3 and 99.2% (first day) obtained with eletrophoresis and miniaturized chromatographic procedures, respectively and, 84.7% after 15 days of its preparation. It is a rapid, practical and reproductive method. (author).

49149 (JAERI-M–90-084) **Behavior of radioactive organic iodide in an atmosphere of High Temperature Gas-cooled Reactor.** Saeki, Masakatsu (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Nakashima, Mikio; Sagawa, Chiaki; Masaki, Nobuyuki; Hirabayashi, Takakuni; Aratono, Yasuyuki. Japan Atomic Energy Research Inst., Tokyo (Japan). Jun 1990. 17p. (In Japanese). Order Number DE90520332. Source: NTIS (US Sales Only), PC A03/MF A01.

Formation and decomposition behavior of radioactive organic iodide have been studied in an atmosphere of High Temperature Gas-cooled Reactor (High Temperature Engineering Test Reactor, HTTR). $Na^{125}I$ was chosen for radioactive iodine source instead of CsI diffusing from coated fuel particles. $Na^{125}I$ adsorbed on graphite was heated in pure He and He containing O_2 or H_2O atmosphere. The results obtained are as follows. It was proved that organic iodide was formed with organic radicals released from graphite even in He atmosphere. Thus, the interchange rate of inorganic iodide with organic iodide was remarkably decreased with prolonged preheat-treatment period at 1000degC. Organic iodide formed was easily decomposed by its recirculation into hot reaction tube kept at 900degC. When organic iodide was passed through powdered graphite bed, more than 70% was decomposed at 90degC. Oxygen and water vapour intermixed in He suppressed the interchange rate of inorganic iodide with organic iodide. These results suggest that organic iodide rarely exists in the pressure vessel under normal operating condition of HTTR, and, under hypothetical accident condition of HTTR, organic iodide fraction never exceeds the value used for a safety assessment of light water reactor. (author).

49150 (JINR-R–6-89-190) **Introduction of astatine into monoclonal antibodies.** Norseev, Yu.V.; Shmakova, N.L. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems. 1989. 8p. (In Russian). Order Number DE91601445. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

It is shown that astatine, retaining its electrophilic properties in a weakly acid mesium, can be introduced into monoclonal antibodies. In an hour the yield of the reaction of electrophilic astatination of antibodies in the phosphate buffer is as high as (30±2)% at pH 6 ato room temperature. The product was purified of astatine that did not reacted by the chromatographic tehnique in the column filled with the gel, type Sephadex G-25. 30 refs.; 1 fig.

49151 (PNL–7145) **Chemical data bases for the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1.** Strenge, D.L. (Pacific Northwest Lab., Richland, WA (USA)); Peterson, S.R. Pacific Northwest Lab., Richland, WA (USA). ©Dec 1989. 530p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-76RL01830. Source: National Energy Software Center (software packages requested by US Government Agencies and their Contractors), Argonne National Lab. Argonne, IL (312-972-7250 or FTS 972-7250). Other requestors should be directed to PNL.

The Multimedia Environmental Pollutant Assessment System (MEPAS) was developed by Pacific Northwest Laboratory for the US Department of Energy (DOE) Office of Environment, Safety, and Health. MEPAS, an enhancement of the Remedial Action Priority System, is a set of computer programs used to prioritize hazardous, radioactive, and mixed-waste sites based on their potential hazard to public health. MEPAS employs a simplified contaminant-transport and exposure model. It incorporates an interactive shell to assist the user in problem definition, data assembly and input, and report development. Two chemical data bases are used by MEPAS. These data bases contain necessary physical properties, toxicities, and transfer parameters for 394 potential pollutants. This report documents the sources of the values contained in Version 1 of the data bases, and the methods used to estimate parameter values are also discussed. 150 refs., 8 tabs.

49152 (PSI–73) **Iodine chemistry and transport calculations for the radioiodine test facility experiments (ACE-RTF) using the MITIMAKS code and the LIRIC data base.** Passalacqua, R.A. (Ontario Hydro Research Lab., Toronto, ON (Canada)). Paul Scherrer Inst. (PSI), Villigen (Switzerland). Jul 1990. 87p. Order Number DE91601385. Source: NTIS (US Sales Only), PC A05/MF A01; OSTI; INIS.

Models for predicting the time-dependent release of iodine from aqueous solutions in the RTF experiments have been assembled using elementary chemical reactions and rate constants available in the LIRIC data base. Results from the computer code MITIMAKS, a new version of the MAKSIMA-CHEMIST code, are discussed and preliminarily compared with other computer analysis. RTF experiments are part of the international ACE (advanced containment experiments) program. The present calculations provide a prediction analysis for a benchmark exercise, with different 'iodine-transport' codes, promoted in the frame of the ACE program itself. (author) 148 figs., 41 tabs., 11 refs.

4008 Combustion, Pyrolysis, and High-Temperature Chemistry

Refer also to citation(s) 48117, 48118, 48119, 48120, 48438, 48890, 48891, 49126, 49394, 50215

49153 (DOE/ER/13600–T4) **Holographic rugate structures for x-ray optics applications: Phase 2 Annual report.** Jannson, T.; Savant, Gajendra.; Qiao, Yong. Physical Optics Corp., Torrance, CA (USA). Jul 1988. 91p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-86ER13600. Order Number DE90017221. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

XUV Bragg Holographic Optical Elements (HOEs), based on a single-step volume holographic recording, have been proposed by Physical Optic Corporation (POC), as an entirely new approach to

x-ray optics. Their theory, as well as the first experimental proof-of-concept, have been demonstrated in Phase 1 of the DOE program. During the first year (exactly, 8-month duration) of the on-going Phase 2, the high-efficiency XUV Lippmann holographic mirrors have been fabricated and their optical, physical, and material properties have been investigated over the entire XUV region (1–100nm). The XUV Bragg HOEs, based on dichromated gelatin (DCG) and on DCG/polymer grafts, have been recorded in the visible region (using an Innova Argo laser) and reconstructed using twelve XUV wavelengths. In addition, these phase high-resolution holographic materials have been shown to be suitable to direct x-ray laser holographic recording (using Princeton's x-ray laser). The volume x-ray holographic recording will be realized within the second year of the program effort.

49154 (EGG-M–90041) **Three-dimensional fluid flow in JFTOT [Jet Fuel Thermal Oxidation Tester].** Oh, C.H.; Merrill, B.J.; Wadkins, R.P. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1990]. 23p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-901109–3: International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers, Dallas, TX (USA), 25-30 Nov 1990). Order Number DE90010929. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes flow and temperature distributions in the Jet Fuel Thermal Oxidation Tester (JFTOT), a standard qualification apparatus for examining thermal stability of jet fuels. A three-dimensional numerical analysis is presented in this paper performed with the KIVA code. This work represents a preliminary attempt to calibrate a Computational Fluid Dynamics/Chemistry (CFDC) model using existing data from a modified JFTOT. Due to the limited amount of data, the deposition model used in this study is a global type Arrhenius relationship. Upon the findings of future JFTOT experiments, the relevant parameters to mass transfer, heat transfer, and fluid dynamics can be combined to define the thermal stability of jet fuel with a higher degree of accuracy. 13 refs., 7 figs.

49155 (LBL–26455, pp. 130) **Spectroscopy and structures of reactive intermediates.** Saykally, R.J. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The objective of this research is to develop new techniques for the detection of unstable forms of molecules, and to use these techniques to carry out detailed measurements of the structures, properties, and dynamics of these species with the goal of improving their large-scale understanding of chemical reactions and energy transfer, as applied to combustion systems. Reactive forms of molecules, including neutral-free radicals and molecular ions, play extremely important roles as reaction intermediates in combustion processes, reactive plasmas, in the terrestrial atmosphere, and in interstellar space. The primary goal of this research, is to carry out detailed investigations of those reaction intermediates that are critical species in the combustion of important fuels. Exactly the same experimental and theoretical techniques employed to study reaction intermediates can be applied to van der Waals molecules; hence, studies of these two crucially important classes of molecules will be undertaken as well, with the long-range objective of correlating the measured properties of these species as a means of understanding condensed phases in more detail.

49156 (N–90-23518) **Fuel-rich catalytic combustion: A fuel processor for high-speed propulsion.** Brabbs, T.A.; Rollbuhler, R.J.; Lezberg, E.A. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1990. 11p. (NASA-TM–103177;E–5555;NAS–1.15:103177;AIAA–90-2319;CONF-900721–: 25. anniversary conference and exhibition of the International Association on Water Pollution Research and Control, Kyoto (Japan), 29 Jul - 3 aug 1990). Source: NTIS, PC A03/MF A01.

Fuel-rich catalytic combustion of Jet-A fuel was studied over the equivalence ratio range 4.7 to 7.8, which yielded combustion temperatures of 1250 to 1060 K. The process was soot-free and the gaseous products were similar to those obtained in the iso-octane study. A carbon atom balance across the catalyst bed calculated for the gaseous products accounted for about 70 to 90 percent of the fuel carbon; the balance was condensed as a liquid in the cold trap. It was shown that 52 to 77 percent of the fuel carbon was C1, C2, and C3 molecules. The viability of using fuel-rich catalytic combustion as a technique for preheating a practical fuel to very high temperatures was demonstrated. Preliminary results from the scaled up version of the catalytic combustor produced a high-temperature fuel containing large amounts of hydrogen and carbon monoxide. The balance of the fuel was completely vaporized and in various stages of pyrolysis and oxidation. Visual observations indicate that there was no soot present.

42 ENGINEERING

Refer also to citation(s) 48491, 49070, 49072, 50232

49157 (LBL–26455, pp. 183) **Thermodynamics of liquid-liquid equilibria including the critical region.** de Pablo, J.J.; Prausnitz, J.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

To obtain good representation in the liquid-liquid critical region, a semitheoretical correction is added to a conventional expression (e.g., van Laar or NRTL) for the excess Gibbs energy of a binary or ternary system along the coexistence curve. This correction is an exponential function of a suitable distance from the critical point; it is significant in the critical region but not elsewhere. In the correction function, the preexponential factor is determined from stability considerations. In the exponential argument, two parameters are determined from theoretical power laws. While the coordinates of the critical point must be known (or estimated), no phase-equilibrium data in the critical region are required to determine parameters. The correction presented here provides an excellent approximation for phase equilibria along the coexistence curve close to and remote from critical conditions. Further, the correction facilitates simultaneous representation of isothermal vapor-liquid and liquid-liquid equilibria, including the liquid-liquid critical region.

49158 (LBL–26455, pp. 183-184) **Molecular thermodynamics of aqueous two-phase systems for bioseparations.** King, R.S.; Blanch, H.W.; Prausnitz, J.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Aqueous polymer-polymer two-phase systems provide a powerful method for separating biomolecules by extraction. When a complex mixture of biomolecules (e.g., a fermentation broth or a solution of lysed cells) is added to such a system, biomolecules partition uniquely between the two phases achieving separation. A thermodynamic framework is presented for optimizing extraction performance in biological separations. First, a molecular-thermodynamic model, based on the osmotic virial equation, is proposed to describe phase equilibria for dilute aqueous mixtures containing polymers and protein. Second, experimental phase-equilibrium data (protein partition coefficients) are reported for a number of model proteins, including albumin, lysozyme, and α chymotrypsin. To interpret and correlate the experimental data, low-angle laser-light scattering (LALLS) measurements were made to determine osmotic second virial coefficients for aqueous mixtures containing polymers, proteins, salts (KCl, KH_2PO_4, and K_2SO_4 at concentrations of 50 and 100 mM), and several combinations of polymer-polymer and polymer-protein pairs. Combined with electrochemical measurements (differences in potential between the two phases and protein net charge), these data provide parameters for the model to calculate the desired phase equilibria. A comparison of calculated and experimental results indicates that the virial-equation model provides good prediction of binodals and a reliable basis for estimating infinite-dilution protein partition coefficients for biotechnical process design.

4202 Facilities, Equipment, and Techniques

Refer also to citation(s) 48224, 48230, 48236, 48240, 48241, 48367, 48382, 48387, 48488, 48651, 49205, 49251, 49252, 49731, 50104, 50244

49159 (AD-A-222952/4/XAB) **Thermal analysis of heat-pipe radiators with a rectangular groove wick structure. Master's thesis.** Yang, C.H. Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering. Jun 1990. 92p. (AFIT/GA/ENY–90J-02). Source: NTIS, PC A05/MF A01.

Performance of a grooved heat pipe radiator has been analyzed to determine its operating characteristics. A heat transfer analysis for the heat pipe is coupled with the analysis of the fin in this study. The effects of heat pipe operating temperature on heat flux and fin efficiency are investigated. Finite difference expressions are used for the grid system of the heat pipe wall and the fin. The heat transfer coefficient of the heat pipe radiator was determined as a function of the operating temperature level. Realistic numerical results were achieved and it was shown that the required heat flux and the temperature difference between the evaporator and condensor both increase with operating temperature. Also, the heat transfer coefficient increased with operating temperature up to a certain point, then began to level-off near a temperature of approximately 400 K. In addition, the overall efficiency of the heat pipe-fin arrangement decreased as the operating temperature level increased.

49160 (CONF-901101–8) **Benchmarking of dose rate calculations for spent fuel transportation casks.** Broadhead, B.L.; Brady, M.C.; Parks, C.V. Oak Ridge National Lab., TN (USA). [1990]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. From American Nuclear Society winter meeting; Washington, DC (USA); 11-15 Nov 1990. Order Number DE90012979. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Nuclear Energy Agency — Committee on Reactor Physics established in 1985 a working group on shielding assessment of transportation packages. Initially a set of six problems was drawn up and distributed to the working group participants. Following preliminary computations by the various participating countries, the initial working group meeting was held at OECD Headquarters in Paris in June/July 1986. The United States (US) contribution to the working group was provided by the authors, and this paper summarizes the US work performed to date. 6 refs.

49161 (CONF-901109–18) **Performances of four magnetic heat-pump cycles.** Chen, F.C.; Murphy, R.W.; Mei, V.C.; Chen, G.L. Oak Ridge National Lab., TN (USA). [1990]. 14p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers; Dallas, TX (USA); 25-30 Nov 1990. Order Number DE90015606. Source: NTIS, PC A03/MF A01 - OSTI.

Magnetic heat pumps have been successfully used for refrigeration applications at near absolute-zero-degree temperatures. In these applications, a temperature lift of a few degrees in a cryogenic environment is sufficient and can be easily achieved by a simple magnetic heat-pump cycle. To extend magnetic heat pumping to other temperature ranges and other types of applications in which the temperature lift is more than just a few degrees requires more involved cycle processes. This paper investigates the characteristics of a few better-known thermomagnetic heat-pump cycles (Carnot, Ericsson, Stirling, and regenerative) in extended ranges of temperature lift. The regenerative cycle is the most efficient one. For gadolinium operating between 0 and 7 T (Tesla) in a heat pump cycle with a heat-rejection temperature of 320 K, our analysis predicted a 42% loss in coefficient of performance at 260 K cooling temperature, and a 15% loss in capacity at 232 K cooling temperature for the constant-field cycle as compared with the ideal regenerative cycle. Such substantial penalties indicate that the potential irreversibilities from this one source (the additional heat transfer that would be needed for the constant-field vs the ideal regenerative cycle) may adversely affect the viability of certain proposed MHP concepts if the relevant loss mechanisms are not adequately addressed.

49162 (JAERI-M–90-064) **A method of using the inverse matrix for manipulator kinematics.** Sasaki, Shinobu (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 33p. (In Japanese). Order Number DE90520210. Source: NTIS (US Sales Only), PC A03/MF A01.

Up to now, some approaches have been proposed and used to the inverse problems of manipulators. As for a six-link manipulator, the kinematic relationships can be simplified into an equation system with four variables by the introduction of a virtual manipulator, which seems novel as an alternative way of looking at the entity of the inverse problem. In place of such an auxiliary method, the inversion of the homogeneous transformation matrix in this process was found to lead to the same results. In this paper, this derivation is shown laying an emphasis on the usefulness of the inverse matrix having the possibility of facilitating the calculation of the link chain. (author).

49163 (ORNL/FTR–3731) **[Mobile robots and intelligent motion control]: Foreign trip report, August 18, 1990–August 25, 1990.** Pin, F.G. Oak Ridge National Lab., TN (USA). 7 Sep 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90017312. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler attended the IEEE International Workshop on Intelligent Motion Control, presented a paper entitled "Autonomous Trajectory Generation for Mobile Robots with Non-Holonomic and Steering Angel Constraints," and chaired the session on mobile robots. Sessions of particular interests to ONRL/CESAR included Mobile Robots 1, 2, and 3, Motion Planning 1 and 2, Flexible Robots, Knowledge-Based Robotics Systems, Multi-Robot Systems, Redundant Robots, and Learning and Fuzzy Control 1 and 2. The traveler also visited the robotics laboratory of Bogazici University and held several discussions on design on redundant, compliant, reconfigurable, and dynamically balanced manipulators.

49164 (SAND–90-1200-C-Extd.Abst.) **An expert system for automated robotic grasping.** Stansfield, S.A. Sandia National Labs., Albuquerque, NM (USA). 10 May 1990. 3p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901101–1: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE90010820. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Many DOE sites and facilities will be environmentally remediated during the next several decades. A number of the restoration activities (decontamination and decommissioning of inactive nuclear facilities is an example) can only be carried out by remote means and will be manipulation-intensive tasks. Experience has shown that manipulation tasks are especially slow and fatiguing for the human operator of a remote manipulator. In this paper, we present a rule-based expert system for automated, dextrous robotic grasping. This system reasons about the features of an object to generate hand shaping and wrist orientation for a robot hand and arm. The system can be used in several different ways to lessen the demands on the human operator of a remote manipulation system — either as a fully autonomous grasping system or one which generates grasping options for a human operator and which then automatically carries out the one selected. This paper examines these systems. 2 figs.

49165 (SAND–90-1248C) **A program to qualify ductile cast iron for use as a containment material for Type B transport cask.** Golliher, K.G. (USDOE Albuquerque Operations Office, NM (USA)); Sorenson, K.B.; Witt, C.R. Sandia National Labs., Albuquerque, NM (USA). [1990]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901160–1: Spectra '90 conference, Oak Ridge, TN (USA), Nov 1990). Order Number DE90013463. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Department of Energy (DOE) is investigating the use of ductile cast iron (DCI) as a candidate material for radioactive material transportation cask construction. The investigation will include materials testing and full-scale cask testing. The major effort will focus on materials qualification and cask evaluation of the 9 meter and puncture drop test events. The test plan shall include a series of drop tests, and several core bars will be removed from the casting wall for material properties testing. Of particular interest is the evaluation of the material microstructure and fracture toughness parameters. Test instrumentation, used to define cask deceleration loads and strain during the drop tests, will be strategically placed in

areas of the greatest structural interest. Part of the testing will include placement of an induced flaw. At the conclusion of the cask drop tests, the induced flaw(s) will be sectioned from the cask body for metallurgical examination. All test results will be documented in the safety analysis report for packaging for submission to the US Nuclear Regulatory Commission (NRC). The goal of this program is a certificate of compliance for DCI from the NRC to transport high-level radioactive materials. The acceptance of DCI within the USA cask design community will offer an alternative to present-day materials for cask construction, and its entry has the potential of providing significant cost-savings.

49166 (SAND–90-2053C) **Improved tracking for bilateral teleoperators with time delay.** Anderson, R.J. Sandia National Labs., Albuquerque, NM (USA). 5 Jul 1990. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901109–13: International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers, Dallas, TX (USA), 25-30 Nov 1990). Order Number DE90015392. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A bilateral teleoperation system consists of a local master manipulator and a remotely located slave manuipulator. Generalized velocity commands are sent forward from the master to the slave, and generalized force/torque information is "reflected" back from the slave to the master. Often there is a transmission delay incurred when communicating between the two subsystems which causes instability in the bilateral teleoperator. Recently, a solution for this instability problem was found, based on mimicking the behavior of a lossless transmission line. Although this solution provides steady-state force and velocity tracking, it does not provide steady-state force and position tracking, as is desired for bilateral teleoperation. In this paper a modification is given to the basic control law which overcomes this difficulty. 13 refs., 6 figs., 1 tab.

49167 (UCRL–101932-Rev.1) **Railgun performance with a two-stage light-gas gun injector: Revision 1.** Hawke, R.S. (Lawrence Livermore National Lab., CA (USA)); Susoeff, A.R.; Asay, J.R.; Ang, J.A.; Hall, C.A.; Konrad, C.H.; Wellman, G.W.; Hickman, R.J.; Heath, W.A.; Martinez, J.R.; Sauve, J.L.; Vasey, A.R.; Shahinpoor, M. Lawrence Livermore National Lab., CA (USA). [1990]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48 ;AC04-76DP00789. (CONF-9004136–9-Rev.: 5. IEEE symposium on electromagnetic launch technology, Destin, FL (USA), 1-5 Apr 1990). Order Number DE90016211. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper summarizes the results obtained with the HELEOS railgun which uses a two-stage light-gas gun (2SLGG) as an injector. The high velocity 2SLGG injector pre-accelerates projectiles up to ~7 km/s. The high injection velocity reduces the exposure duration of the railgun barrel to the passing high temperature plasma armature, thereby reducing the ablation and subsequent armature growth. The 2SLGG also provides a column of cool, high pressure hydrogen gas to insulate the rails behind the projectile, thereby eliminating restrike. A means to form an armature behind the injected projectile has been developed. In preliminary tests, the third stage railgun has successfully increased the projectile velocity by 1.35 km/s. Extensive diagnostics have been used to determine the behavior of the armature and track the launcher's performance. In some cases, velocity increases in the railgun section have been achieved, which are in close agreement with theoretical predictions, whereas in other experiments deviations from theoretical have been observed. The reasons for and implications of these results are addressed. Recent tests are reported. 17 refs., 7 figs., 1 tab.

49168 (UCRL–102264) **Respirator standards, regulations, and approvals in the USA.** Held, B.J. Lawrence Livermore National Lab., CA (USA). Nov 1989. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-901113–1: Japanese Section of the International Society of Respiratory Protection conference, Tokyo (Japan), 24 Nov 1990). Order Number DE90003917. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Before 1971, respirator approval and use in the United States was relatively simple. The United States Bureau of Mines certified and approved respirators on a voluntary basis for those users who wanted assurance that the respirators they purchased met minimum requirements. Respirator users got some direction on how to use the equipment from manufacturers, trade journals, and the American National Standards Institute (ANSI). Since 1971, we have been overwhelmed with regulations, standards, attempts to change approval requirements, and research all of which has led to general confusion about where responsibilities lie and how much protection a respirator really gives. This paper tries to untangle some of that confusion and to draw some conclusions about where respiratory protection in the US may be heading.

49169 (Y/DX–943) **A process monitoring strategy for a Precision Flexible Manufacturing System.** Barkman, W.E.; Babelay, E.F.; Hebble, T.L.; Williams, R.R. Oak Ridge Y-12 Plant, TN (USA). [1990]. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OS21400. (CONF-901109–6: International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers, Dallas, TX (USA), 25-30 Nov 1990). Order Number DE90012970. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

For a number of years, the Oak Ridge Y-12 Plant has been involved in an endeavor which is described as a Precision Flexible Manufacturing System (PFMS). The objective of this project is to enhance the existing manufacturing operations for the production of precision hemispherical workpieces. The present fabrication process uses T-base lathes, similar to the one shown in figure 1, which are equipped with a Computer Numerical Control (CNC) system. The CNC systems are coupled to a host computer over a local area network (LAN). Currently, this link is used to download machining part programs and upload limited process information. While the enhanced system will use the same machine tools and LAN, additional capabilities will be provided to perform automatic tool changing, part and fixture handling, on-machine gagging, and chip control. The project's quality goals are to automatically manufacture workpieces to tolerances of +/- 0.0005 in. on contour and +/- 0.001 in. on wall thickness with a 3 to 5 sigma level of confidence. The parts will range from 4 to 10 in. in diameter with a wall thickness as large as one inch. 2 refs., 6 figs.

49170 Certification challenges in the development of an innovative high payload capacity spent fuel transportation cask. Nair, B.R. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Waste Dept.); Severson, W.J.; Ciez, A.P. pp. 492-497 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper presents the design approach and certification strategy used in the development of an innovative transportation cask for legal weight truck shipments of spent nuclear fuel. The proposed approach represents a significant departure from conventional cask designs in that it uses titanium alloy, a material with a high strength-to-weight ratio which has no precedent in transportation cask certification. The significant increase in payload obtainable with the proposed approach, and the associated benefits such as reduced life cycle costs, lower personnel exposure, and lower transportation accident risks are discussed.

49171 An innovative cask for transporting defense high-level waste. Falci, F.P. (U.S. Dept. of Energy, Washington, DC (US)); Allen, G.C.; Madsen, M.M.; Zimmer, A.; Golliher, K.G. pp. 486-491 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). DOE Contract AC04-76DP00789 ;AC04-80SF10791. (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses a transportation project to develop a truck cask that would represent the leading edge of cask technology as well as fully comply with all applicable regulations. A particular cask design is summarized. The authors review a safety analysis report for packaging that has been submitted for certification.

49172 BR-100 spent fuel shipping cask development. McGuinn, E.J. (B&W Fuel Co., Lynchburg, VA (US)); Childress, P.C. pp. 481-485 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA)

(1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses the establishment of an integrated waste management system for spent nuclear fuel. Development of a spent-fuel cask that is compatible with both rail and barge modes of transportation is addressed. Design approaches are presented.

49173 State of Nevada nuclear waste shipping cask design studies. Halstead, R. (Agency for Nuclear Projects, Nuclear Waste Project Office, Capitol Complex, Carson City, NV (US)); di Bartolo, R. pp. 465-473 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This paper discusses a cask development program, including rigorous cask performance standards to reflect severe accident conditions and greater consideration of human error in all phases of cask design, certification, manufacture and operation. Three contractor studies are presented. Preliminary findings are given.

49174 Optimizing spent fuel cask designs for use in the federal waste management system. Kouts, C.A. (Idaho National Engineering Lab., Idaho Falls, ID (USA)); Lake, W.H.; Henry, K.H.; Chapman, R.L. pp. 457-460 of High level radioactive waste management: Volume 1. American Nuclear Society, La Grange Park, IL (USA) (1990). (CONF-900406–: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990).

This patent describes discusses the design and development of a new fleet of casks to transport spent fuel using innovative approaches to optimize the cask designs. Preliminary casks' designs are described. The responsibility for developing a waste-management system for the disposal of the nation's nuclear waste is presented.

49175 Examples of robots and teleoperators at the Savannah River Site. Ward, C.R. (Savannah River Lab., Aiken, SC (USA)); Heckendorn, F.M.; Vandewalle, R.C. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA)*, 37(3): 1437-1442 (Jun 1990). DOE Contract AC09-76SR00001. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The Savannah River Site manufactures nuclear materials for the U.S. Department of Energy. This paper describes how in recent years robots and mobile teleoperators have been used to reduce the radiation exposure of personnel at this site. The Shielded Cells Waste Handling Robot and the Shielded Cells Sampling Handling Robot have both significantly reduced radiation exposure. The Shielded Cells Waste Handling Robot has been in operation for over four years. It removes cans of radioactive waste from the Shielded Cells, seals the can in a plastic bag, and places the cans in a waste drum. The Shielded Cells Sample Handling Robot has been in operation for only a few months. It opens a door to one of the Shielded Cells, removes a radioactive sample from a shielded container, places it in the cell, and closes the door. Mobile teleoperators have significantly reduced radiation exposure in the removal of a contaminated junction box, and lead removal from radioactive vessels.

49176 Robotic requirements for plutonium handling automation. Heywood, A.C. (Scientific Applications International Corp. (US)); Armantrout, G.A. *IEEE Transactions on Nuclear Science (institute of Electrical and Electronics Engineers) (USA)*, 37(3): 1452-1455 (Jun 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

While over 200,000 robots are in manufacturing service worldwide, only two are in use for the handling of plutonium in a glovebox. The difficulties of applying robotics to the glovebox environment include limited access for service and maintenance, radiation damage to electronics and insulators, and abrasion damage to bearings and sliding surfaces. The limited volume of the glovebox environment, and the need to handle heavy workloads, and the need to maximize work volume dictates the use of an overhead gantry system. This paper discusses how the application of such a system will require a robot with extensive safety features, a high degree of flexibility to perform a variety of tasks, and high reliability coupled with an easily serviced design. Substantial challenges exist in control system design, sensor and operator integration, and programming to achieve these goals.

4204 Heat Transfer and Fluid Flow

Refer also to citation(s) 48577, 48617, 48645, 48658, 48772, 48773, 48805

49177 (CONF-901109–8) **Unsteady fluid forces and fluidelastic vibration of a group of circular cylinders.** Chen, S.S. Argonne National Lab., IL (USA). [1990]. 15p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers; Dallas, TX (USA); 25-30 Nov 1990. Order Number DE90013661. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

When a single cylinder oscillates in a quiescent fluid, its natural frequencies and model damping values are affected by the surrounding fluid; these fluid effects can generally be accounted for by fluid added mass and fluid damping forces. In a flowing fluid, added mass and fluid damping are dependent of flow velocity, and other fluid force components, fluid-stiffness force and fluid excitation force, are also important. In contrast to an isolated cylinder, the motion of a particular cylinder in a group will excite the surrounding cylinders; this type of oscillations is generally called fluidelastic vibration. Fluidelastic vibrations of multiply cylinders are attributed to fluid inertia, fluid damping, and fluid stiffness forces as well as fluid excitation forces. Once the fluid excitation forces and motion-dependent fluid forces acting on cylinders are known, coupled fluidelastic oscillations of a group of cylinders can be analyzed. The objectives of this note are to summarize recent development of the state-of-the-art of this subject, including quiescent fluid, axial flow, crossflow, and future research needs. 101 refs.

49178 (DLR-FB–90-18) **A computer program system for the analysis of 3-d steady flows in turbomachinery components.** Hoffmann, W. (Deutsche Forschungsanstalt fuer Luft- und Raumfahrt e.V. (DLR), Koeln (Germany, F.R.). Inst. fuer Antriebstechnik). Deutsche Forschungsanstalt fuer Luft- und Raumfahrt e.V. (DLR), Koeln (Germany, F.R.); Bochum Univ. (Germany, F.R.). Fakultaet fuer Maschinenbau. 1990. 162p. (In German). Order Number DE90520015. Source: NTIS (US Sales Only), PC A08/MF A01.

A modular, dynamically startable program system to calculate viscous flows in turbo-machine components is presented. Local flow phenomena including boundary layers, secondary flows and shock waves can be analysed. The program system modules form a consistent shell supporting both, routine calculations of flow case types already installed, and the development of new program modules. The system can generate and display computing grids for axial and radial turbomachines. An explicit/implicit time-marching scheme to calculate 3-d Reynolds-averaged Navier-Stokes equations with algebraic turbulence model is implemented. A subprogram system for solution data interpretation and flow visualization is also included. A high-pressure radial impeller solution is presented as an example. Special emphasis is laid on secondary flow analysis. (orig.) With 52 figs., 14 tabs., 103 refs.

49179 (DOE/CE/90029–3) **Experimental and theoretical studies of friction and heat transfer in rough passages: Progress report, April 15, 1990–July 31, 1990.** Obot, N.T.; Esen, E.B.; Snell, K.H. Clarkson Univ., Potsdam, NY (USA). Aug 1990. 9p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG02-89CE90029. Order Number DE90016302. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper is a progress report on experimental and theoretical studies of friction and heat transfer in rough passages and is conducted at Clarkson University, Potsdam, NY. During this reporting period from April 15 to July 31, 1990, with the completion of the final report on the theoretical aspects of the research program in

April 1990, efforts have been directed to the experimental studies. Measurements of isothermal pressure drop in smooth and spirally-fluted tubes that were intended to establish the reliability of the flowmeter and pressure transducer calibrations as well as the instrumentation were completed. 2 refs., 5 figs.

49180 (EGG-M–90067) **Effect of calcium sulfate on pool boiling of enhanced heat transfer surfaces.** Somerscales, E.F.C. (Rensselaer Polytechnic Inst., Troy, NY (USA)); Curcio, L.A. Jr. EG and G Idaho, Inc., Idaho Falls, ID (USA). Mar 1990. 39p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FC07-88ID12772 ;AC07-76ID01570. (CONF-901109–5: International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers, Dallas, TX (USA), 25-30 Nov 1990). Order Number DE90013099. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes experiments carried out to investigate the effect of precipitation fouling under nucleate pool boiling conditions on the heat transfer of a number of commercially available enhanced heat transfer surfaces. The effects of time of exposure, level of the heat flux, and form of the surface enhancement were investigated. The test fluid was a saturated aqueous solution of calcium sulfate in which the surfaces were continuously exposed for up to 20 hour. The results indicate that fouling, indicated by the change in the wall superheat, occurs immediately on exposure of the test surface to the fluid and the effect becomes constant within two to five hours of five hours of first exposing the surface. The effect of precipitation fouling is greater at higher heat fluxes. The effects of fouling depend on the geometry of the surface enhancement with those surfaces having the lower superheat under clean conditions also exhibiting a lower effect of fouling. 15 refs., 10 figs.

49181 (IFVE-OUNK–89-114) **Measurement of the longitudinal thermal conductivity for spiral tube-fin heat exchanger structure for helium facilities.** Ageev, A.I.; Levin, M.V.; Smykov, G.B.; Shamichev, A.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 6p. (In Russian). Order Number DE91600999. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The results on measuring the spiral tube fin heat exchanger (HE) longitudinal heat conductivity are given. This HE is made from coiled copper tubes spirally finned with a copper wire. This type of HE will be used in the cryogenic system for accelerator-storage ring complex. 9 refs.; 3 figs.; 1 tab.

49182 (KURRI-TR–327, pp. 70-77) **Cold neutron source as heat pipe.** Kawai, Takeshi (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jan 1990. (In Japanese). (CONF-8901187–: Workshop on the cooling of high-performance reactors, Kumatori (Japan), 17-18 Jan 1989). In *Proceedings of the workshop on the cooling of high-performance reactors.* Order Number DE90777871. Source: NTIS (US Sales Only), PC A08/MF A01.

Cold neutrons usually mean the neutrons having wavelength longer than 4A, and those are suitable to study the fluctuation near the critical point in the phase change of living body molecules and amorphous substances and the long period structure. In ordinary reactors, the intensity of cold neutrons is 1-2% of the total neutron flux. Accordingly, it is desirable to augment cold neutron flux also in view of the improvement of the efficiency of utilizing neutrons. For this purpose, the cold neutron source from which cold neutrons are taken out by scattering and moderating thermal neutrons through extremely low temperature moderator, liquid hydrogen, is used. In order to store the required, sufficient quantity of liquid hydrogen at 20 K against nuclear heat generation, as the means of heat removal, closed thermal siphon type cold neutron sources are used. The main part is a hydrogen low temperature system comprising a cold moderator tank, transport piping and a condenser, and it can be regarded as a heat pipe. The analysis of flooding phenomena and self equilibrating property, sudden boiling phenomena and self equilibrating property, and the solidification of liquid hydrogen and self equilibrating property are explained. (K.I.).

49183 (KURRI-TR–327, pp. 121-131) **Present status of research on boiling critical heat flux at low flow velocity.** Mishima, Kaichiro (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jan 1990. (In Japanese). (CONF-8901187–: Workshop on the cooling of high-performance reactors, Kumatori (Japan), 17-18 Jan 1989). In *Proceedings of the workshop on the cooling of high-performance reactors.* Order Number DE90777871. Source: NTIS (US Sales Only), PC A08/MF A01.

The flowing boiling critical heat flux at low flow velocity, for example in natural circulation boiling, is important in relation to the safety of the nuclear reactors of liquid cooling type under various conditions. The circumstance of removing the decay heat generated in a core by natural circulation has the larger possibility to occur than the condition of high flow velocity and high thermal load which has been studied in wide range so far, in addition, though the phenomena are gentle, sometimes range effect is caused. For example, the core cooling after a loss of coolant accident in a LWR is the low flow velocity condition being considered here. The published literatures on the critical heat flux under high pressure, low flow velocity condition are few. In this report, a number of the results of the research carried out at the Kyoto University Reactor Research Institute are summarized. The mechanism of critical heat flux and the basic equations, the critical heat flux in circular pipes, double walled pipes and rectangular pipes, the critical heat flux in the channel with a group of tubes, and the minimum value of critical heat flux are reported. (K.I.).

49184 (KURRI-TR–327, pp. 132-142) **Present status of research on boiling critical heat flux in narrow channel.** Nariai, Hideki (Tsukuba Univ., Ibaraki (Japan). Inst. of Engineering Mechanics). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jan 1990. (In Japanese). (CONF-8901187–: Workshop on the cooling of high-performance reactors, Kumatori (Japan), 17-18 Jan 1989). In *Proceedings of the workshop on the cooling of high-performance reactors.* Order Number DE90777871. Source: NTIS (US Sales Only), PC A08/MF A01.

The authors supposed the cooling of high thermal load machinery and equipment, and have advanced the experimental research on forced flow subcooling boiling critical heat flux using water. At present for the heat removal from high thermal load machinery and equipment, the water cooling utilizing subcooling boiling is the only method. In the experiment, direct Joule heat generation was caused in a stainless steel circular pipe with the current from a low voltage, large current DC power source, and water was flowed in the pipe. The relatively narrow channel of 1-3 mm inside diameter was used. By this experiment, the critical heat flux characteristics, the pressure loss and flow characteristics in subcooling boiling in a narrow channel, the void ratio and critical heat flux characteristics in fine pipes and so on were obtained. The experimental setup and experimental condition, forced flow subcooling boiling critical heat flux, high heat flux zone and low heat flux zone, the comparison with the conventional empirical formulas, the modified Tong formula, the connection with the quality zone, frictional pressure loss and flow characteristics and others are reported. (K.I.).

49185 (KURRI-TR–327, pp. 143-152) **Present status of heat transfer in narrow gap rectangular channel.** Sudo, Yukio (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Kaminaga, Masanori. Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jan 1990. (In Japanese). (CONF-8901187–: Workshop on the cooling of high-performance reactors, Kumatori (Japan), 17-18 Jan 1989). In *Proceedings of the workshop on the cooling of high-performance reactors.* Order Number DE90777871. Source: NTIS (US Sales Only), PC A08/MF A01.

In the safety evaluation for research nuclear reactors, at the time of abnormal transient change and accidents, after the tripping of a primary coolant pump, such event that the flow direction of coolant in a core reverses from steady downward flow to rising flow is supposed. In this case, the coexisting convection field, in which free convection and forced convection coexist, arises in place of forced convection, and especially in the research reactors using plate type fuel like JRR-3, it is important to grasp the heat transfer characteristics in the coexisting convection field in a narrow channel. Jackson et al. proposed the heat transfer correlation equation which can be applied to wide conditions including the coexisting

convection zone, but its applicability to a narrow channel has not been confirmed. Based on the experimental results, in this study, the effect that the decrease of gap exerts to the convection heat transfer characteristics reported so far was investigated. The experiment and the results are reported. In this experiment on the coexisting convection zone in a narrow gap, the effect of main flow acceleration arose sufficiently large as compared with the effect of buoyancy, and heat transfer was promoted. (K.I.).

49186 (OH/RD–89-230-K) **Infrasonic enhancement of heat transfer: Preliminary report.** Woods, B.G. Ontario Hydro, Toronto, ON (Canada). Research Div. 17 Nov 1989. 24p. (MICROLOG–90-03526). Source: PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

Claims have been made that infrasound can be used to significantly reduce electricity consumption in a convection heating process (up to 94%) in a convection heating process by enhancing the rate of heat transfer. In response to these claims, preliminary laboratory tests were performed to evaluate the electricity savings potential of infrasound. The results from the tests indicate that when infrasound is applied to steady air flow, the convection heat transfer is significantly increased. In certain conditions, the rate of heat transfer was double the rate in steady air flow. However, as the air flow rate was increased, the degree of heat transfer enhancement decreased; under steady flow conditions, infrasound can increase the rate of heat transfer by a factor of 2. The efficiency of the infrasound unit tested was very low (aproximately 0.04%), therefore it could not be used to reduce the total electricity consumption in a forced convection process. However, a more efficient method for generating the infrasound, if available, could achieve a net reduction in the electricity consumption. Recommendations are made for future research. 8 refs., 12 figs., 3 tabs.

4205 Materials Testing

Refer also to citation(s) 48294, 48580, 48877, 48912, 49318, 49393, 50239

49187 (CONF-900757–5) **X-ray microprobe-microscopy.** Sparks, C.J.; Ice, G.E. Oak Ridge National Lab., TN (USA). [1990]. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 15. international conference on x-ray and inner-shell processes; Knoxville, TN (USA); 9-13 Jul 1990. Order Number DE90017327. Source: NTIS, PC A03/MF A01 - OSTI.

X rays have a unique interaction with matter that offers many advantages over electrons and other charged particles for the microcharacterization of materials. X rays are more efficient in photoejecting inner shell electrons resulting in characteristic X-ray fluorescence. X rays also result in less Bremsstrahlung to produce higher fluorescent signal-to-background ratios than obtained with electrons. Detectable limits for X-ray produced fluorescence could be a few parts per billion which are 10^{-3} to 10^{-5} lower than for electron excitation. Energy deposition in the sample from X rays is $^{-3}$ to 10^{-4} less than for electrons for the same detectable limit. High-brightness storage rings, such as the planned Advanced Photon Source in the 7 GeV class with undulators, will have sources as brilliant as the most advanced electron probes. The highly collimated X-ray beams from undulators simplify the X-ray optics required to produce submicron-sized X-ray probes having fluxes comparable electron sources. Such X-ray microprobes will also produce unprecedentedly low levels of detection in diffraction, EXAFS, Auger, and photoelectron spectroscopies for structural and chemical characterization and elemental identification. An X-ray microprobe will improve our microcharacterization capabilities and will have major applications in materials and environmental sciences and in physics, chemistry, geochemistry, biology, and medicine. Some current applications are shown. 46 refs., 7 figs., 3 tabs.

49188 (EM–92, pp. 181-189) **Case studies of Ontario Hydro's experience with standard tests for alkali-aggregate reactivity.** Hooton, R.D. (Ontario Hydro, Toronto, ON (Canada)). Ontario Ministry of Transportation, Downsview, ON (Canada). Engineering Materials Office. 19 Mar 1990. (CONF-9003203–: Canadian developments in testing concrete aggregates for alkali-aggregate reactivity, Toronto (Canada), 19 Mar 1990; MICROLOG–90-04210). In *Canadian developments in testing concrete aggregates for alkali-aggregate reactivity*. Source: PC Ontario Ministry of Transportation, Engineering Materials Office, 1201 Wilson Ave., Central Bldg., Downsview, ON, CAN M3M 1J8; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Standard test methods for detecting potentially deleterious alkali-reactive aggregates or aggregate-cement combinations are described. Results of these methods to pre-test materials for use in concretes are not always found to be consistent; in some cases, a deleteriously reactive aggregate may pass one or more of the tests, and less frequently, a good aggregate can fail a test. The best indicator of an aggregate's durability is previous field experience or a survey of existing structures made with similar aggregate-cement combinations in a moist environment. A number of case studies are examined in which concretes used in Ontario Hydro generating station structures are investigated and anomalous laboratory tests were revealed. As a result, some tests have been found to lack reliability and have been discontinued. Recommendations are made for conducting alkali-aggregate reactivity tests. 7 refs., 7 figs.

49189 (IS-M–627) **Fatigue crack characterization by ultrasonic inspection.** Buck, O. (Ames Lab., IA (USA)); Thompson, R.B.; Rehbein, D.K. Iowa State Univ. of Science and Technology, Ames, IA (USA). [1989]. 2p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. (CONF-8905344–1: ASTM symposium on quantitative methods in assessment of standard defects, Kansas City, MO (USA), 25-26 May 1989). Order Number DE90017252. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This is a two page report on ultrasonic inspection of fatigue crack characterization. (JDL)

49190 (SAND–90-1323C) **Computer modeling of 12-inch actuator shock test performance.** Bell, R.G.; Baca, T.J. Sandia National Labs., Albuquerque, NM (USA). [1990]. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9010172–3: 61. shock and vibration symposium, Pasadena, CA (USA), 16-18 Oct 1990). Order Number DE90017038. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The 12-Inch Horizontal Actuator is a high velocity mechanical shock simulation testing device used for component development shock testing at Sandia National Laboratories. This machine is pneumatically driven and propels a ram sled along a track where a programmed shock pulse is generated during an impact with another sled containing the test item. Computer models have been developed which allow prediction of: (1) actuator performance in terms of pressure setting which produce the desired initial thrust of the ram sled; (2) sled brake performance which is needed to ensure stopping the sleds within length of the sled track; and (3) shock pulse amplitude and duration parameters associated with the desired shock test input. Experimental results are presented which verify the accuracy of the models. The modeling effort has significantly improved test efficiency by reducing the number of calibration tests required to develop required shock loading conditions. Successful development of these computer models demonstrates the great potential of computer applications in improving the quality of unique test capabilities such as the 12-Inch Actuator. 5 refs., 7 figs., 3 tabs.

49191 (SAND–2033C) **Short and long loop manufacturing feedback using a multi-sensor assembly test chip.** Sweet, J.N.; Tuck, M.R.; Peterson, D.W.; Palmer, D.W. Sandia National Labs., Albuquerque, NM (USA). [1990]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9010158–2: 9. IEEE/CHMT international electronics manufacturing technology symposium, Washington, DC (USA), 1-3 Oct 1990). Order Number DE90017595. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A three generation family of CMOS silicon test chips for packaging diagnostics has been developed. These Assembly Test Chips

(ATC) contain sensors that measure a number of variables associated with assembled IC degradation, including the degree of IC corrosion, handling damage, ESD threat, ppm, moisture, mechanical stress, mobile ion density, bond pad cratering, and high speed logic degradation. The ATC family are intended to give manufacturing feedback in four ways: direct feedback in evaluation of an Assembly Manufacturing Line in an objective, non-intrusive way; before and after comparisons on an assembly production line when an individual process, material, or piece of equipment has been changed; resident lifetime monitor for system package aging and ongoing reliability projection and thermal, mechanical, dc electrical, and high frequency mock-up evaluation of packaging (including multichip) schemes. 14 refs., 6 figs., 2 tabs.

4210 Combustion Systems

Refer also to citation(s) 48117, 48118, 48119, 48120, 48294, 48890, 48891, 49406

49192 (N–90-23591) **Introducing the VRT gas turbine combustor.** Melconian, J.O.; Mostafa, A.A.; Nguyen, H.L. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1990. 14p. (NASA-TM–103176;E–5554;NAS–1.15:103176;AIAA–90-2452;CONF-900720–: 26. AIAA/SAE/ASME/ASEE joint propulsion conference and exhibit, Orlando, FL (USA), 16-18 Jul 1990). Source: NTIS, PC A03/MF A01.

An innovative annular combustor configuration is being developed for aircraft and other gas turbine engines. This design has the potential of permitting higher turbine inlet temperatures by reducing the pattern factor and providing a major reduction in NO(x) emission. The design concept is based on a Variable Residence Time (VRT) technique which allows large fuel particles adequate time to completely burn in the circumferentially mixed primary zone. High durability of the combustor is achieved by dual function use of the incoming air. The feasibility of the concept was demonstrated by water analogue tests and 3-D computer modeling. The computer model predicted a 50 percent reduction in pattern factor when compared to a state of the art conventional combustor. The VRT combustor uses only half the number of fuel nozzles of the conventional configuration. The results of the chemical kinetics model require further investigation, as the NO(x) predictions did not correlate with the available experimental and analytical data base.

49193 (N–90-24349) **Combustor design and analysis using the Rocket Combustor Interactive Design (ROCCID) methodology.** Klem, M.D.; Pieper, J.L.; Walker, R.E. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1990. 11p. (NASA-TM–103165;E–5537;NAS–1.15:103165;AIAA–90-2240;CONF-900720–: 26. AIAA/SAE/ASME/ASEE joint propulsion conference and exhibit, Orlando, FL (USA), 16-18 Jul 1990). Source: NTIS, PC A03/MF A01.

The ROCket Combustor Interactive Design (ROCCID) Methodology is a newly developed, interactive computer code for the design and analysis of a liquid propellant rocket combustion chamber. The application of ROCCID to design a liquid rocket combustion chamber is illustrated. Designs for a 50,000 lbf thrust and 1250 psi chamber pressure combustor using liquid oxygen (LOX)RP-1 propellants are developed and evaluated. Tradeoffs between key design parameters affecting combustor performance and stability are examined. Predicted performance and combustion stability margin for these designs are provided as a function of the combustor operating mixture ratio and chamber pressure.

4220 Mining and Underground Engineering

Refer also to citation(s) 49737

4230 Marine Engineering

Refer also to citation(s) 48443, 48894, 48971

49194 (CSCE–CE03117, pp. 183-212) **Offshore ice problems in the Arctic Sea.** El-Nour, R.A. (Arctec Newfoundland, St.John's, NF (Canada)). Canadian Society for Civil Engineering, Montreal, PQ (Canada). 1987. (CONF-8705408–: 8. Canadian hydrotechnical conference, Montreal (Canada), 19-22 May 1987; CE–03117). In *Eighth Canadian hydrotechnical conference: Proceedings.* Source: Canadian Society for Civil Engineering, 2050 Mansfield St., Montreal, PQ, CAN . Prices: $30.00 CAN.

This paper presents an overview of the technology that has been developed to resolve problems encountered in designing marine structures for the Canadian Arctic. The extreme temperature variation characteristic of the Arctic environment introduces a number of phenomena which often cannot be adequately described by traditional analytic methods. These effects are associated with different ice covers, permafrost and tidal forces. This work focuses on developments affecting the interactions of structures with ice covers. The majority of existing offshore structures have been assessed by means of ice basin mode test methods which simulate a broad range of ice loading conditions. It has been found that a number of environmental factors influence local presses and global forces acting on a structure, including friction, ice density, compressive strength, flexual strength and fracture toughness. These ice properties have been modelled using both refrigerated and synthetic mode ice. Mechanisms of ice failure have been extensively examined during the past 15 years by means of lab tests and full scale trials. The engineering expertise obtained from model tests and field trials has been embodied into design procedures which account for ice hazards, leading towards a limit state approach in the proposed CSA (Canadian Standards Assocation) Code for offshore and Arctic structures. Various ice management techniques have also been devised for protecting coastal structures and extending their performance and period of operation. 28 refs., 15 figs., 2 tabs.

49195 (OTH–87-247) **Effectiveness of concrete to protect steel reinforcement from corrosion in marine structures.** Department of Energy, London (UK); Construction Industry Research and Information Association Underwater Engineering Group (CIRIA/UEG), London (UK). 1988. 177p. Source: Available from H.M. Stationery Office, London, price Pound 36.50.

Concrete in the Oceans technical report no. 24.

A laboratory evaluation of how variations in cover design and properties determine its effectiveness in controlling corrosion in reinforced concretes in marine structures is described. The effect of concrete type and composition on chloride ingress and corrosion rate was studied for four simulated marine environments. Contrary to expectation, significant corrosion did not take place in reinforcement placed at 30 mm cover after 30 months exposure, even in concretes of lower strengths and higher water/cement ratios than mixes employed in the North Sea. Unexpected crevice corrosion let to the exclusion of electrochemical data and restricted the opportunity of correlating the properties of the cover with the onset and rate of corrosion of reinforcement. The project did, however, provide valuable data on in situ strength, moisture content, permeability, resistivity, carbonation and rate of chloride ingress. Limited data is also available on the pore structure of the cover and its oxygen diffusion characteristics. It is emphasised that all results refer to uncracked concrete. (author).

49196 (OTH–88-287) **Analysis of uncertainties in environmental loading on offshore structures.** Carr, P. (Atkins Oil and Gas Engineering Ltd., London (GB)). Department of Energy, London (UK). Offshore Energy Technology Board. 1989. 34p. Source: Also available from H.M. Stationery Office, price Pound 25.50.

When environmental loading calculations are performed for an offshore structure, the results are subject to considerable uncertainty. These loading uncertainties arise partly from uncertainties in the input parameters and partly from uncertainties in the calculation methodology. This report describes a systematic method for ranking the importance of the parametric and methodological uncertainties to the resulting load values. The method uses a technique called an "uncertainty tree analysis" in which a tree structured diagram represents the functional relationships between input and output variables. The uncertainties in the input variables are described by probability distributions. By an analysis of the tree, a corresponding probability distribution may be obtained for the output variable. The analysis is applied to uncertainties influencing base shear and overturning moment. (UK).

49197 (OTI–89-541) **Wave force experiments at the Christchurch Bay Tower with simulated hard marine fouling.** Bishop, J.R. (British Maritime Technology Ltd., Southampton (GB). CEEMAID Div.). Department of Energy, London (UK). 1988. 33p. Source: Available from H.M. Stationery Office, London, price Pound 12.75.

The wave forces on a rough vertical cylinder have been measured using the small column of the Christchurch Bay Tower. The cylinder diameter was 500mm and the forces were measured at three depth stations. The roughness was in the form glued-on pyramids with an average height of 20mm, giving a roughness height/diameter ratio of 0.039. The wave particle kinematics were measured by perforated ball instruments situated near to the force-measuring cylinders. Force coefficients for the total, drag and inertia forces were obtained. The values of the drag coefficients were in the region of 1.1 at a Keulegan Carpenter number of 15, falling to 0.9 at a Keulegan Carpenter number of 35. The inertia coefficient was in the region of 1.9. The force coefficients were very similar at all three depth stations. (author).

49198 (OTO–89-005) **The loading on offshore structures from breaking waves.** Rainey, R.C.T. (Atkins (W.S.), Bristol (GB)). Department of Energy, London (UK). Offshore Energy Technology Board. May 1989. 281p. Project PEN/C–2388. (E–1308/R001). Source: Available from British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ No. DX86817.

Recent developments in the theoretical study of breaking waves have shown conclusively that these waves have a region where fluid accelerations are an order of magnitude greater than previously thought. This project investigates the implications of these high accelerations on the fluid loading on tubular members typical of jacket structures in shallow UK coastal waters where, it is acknowledged, breaking waves can occur. Results from a recently published authoritative description of breaking waves are used to determine wave kinematics in a representative breaking wave. The obtained fluid velocities and accelerations are used to calculate drag and inertial components of fluid loading and to compare the inertial components. (author).

49199 (WAU/CGS–CE03140, pp. 143-154) **The influence of placement methods on the in-situ density of hydraulic sand fills.** Sladen, J.A. (Hardy BBT Ltd., Calgary, AB (Canada)); Hewitt, K.J. Canadian Geotechnical Society, Waterloo, ON (Canada). 1989. (CONF-891015–: 42. Canadian geotechnical conference, Winnipeg (Canada), 23-25 Oct 1989; CE–03140). In *Materials: From theory to practice: Proceedings.* Source: Canadian Geotechnical Society, University of Waterloo, Waterloo, ON, CAN . Prices: PRICES UPON REQUEST.

The range of densities achievable by hydraulic placement of sand straddles the boundary between acceptable and unacceptable potential performance. This has led to concerns over the safety of structures using hydraulic fills, such as the artificial drilling islands in the Canadian Beaufort Sea. Liquefaction failures of hydraulically placed sand have occurred on at least four of these islands. Until recently, the factors affecting in situ density were little understood. Data obtained from several artificial islands are presented and these are used to demonstrate the overwhelming influence of the method of placement on in situ density. For example, hopper-placed Beaufort Sea sand is much denser than pipeline-placed sand. The possible reasons for this influence and the implications for design are discussed. Recommendations are made for research that, together with conclusions drawn in the paper, should allow hydraulic fills to be used with more confidence in the future. 25 refs.

4250 Power Cycles

Refer also to citation(s) 48470, 48805, 49161

4260 Components, Electron Devices and Circuits

Refer also to citation(s) 48467, 48497, 48686, 48793, 48895, 48916, 48977, 49038, 49125, 49140, 49191, 49270, 49271, 49272, 49273, 49274, 49319, 49324, 49334, 49336, 49337, 49338, 49339, 49340, 49342, 49343, 49348, 49356, 49358, 49368, 49371, 49372, 49374, 49380, 49381, 49382, 49390, 49398, 49406, 50246

49200 (AD-A–222607/4/XAB) **SDIO/1st ultrashort wavelength laser - novel experimental schemes for observing the Moessbauer Effect in long-lived nuclear levels and nuclear coherent states. Final technical report for period ending 26 May 1990.** Hoy, G.R. Old Dominion Univ., Norfolk, VA (USA). Dept. of Physics. May 1990. 31p. Contract N00014-87-K-2015. (PTR–90-4). Source: NTIS, PC A03/MF A01.

Our results indicate that the Mossbauer Effect is occuring for the 88-keV transition of Silver 109 in silver single crystals. Furthermore, the effect appears to be an order of magnitude smaller in the horizontal geometry than in the vertical geometry. Using our model calculations, the size of the M.E. in the vertical geometry is consistent with a line broadening factor of only about 5. This would appear to be an unphysical result. These results suggest that gravitational sweeping is playing a significant role in producing an observable M.E.. Very soon we will make further model calculations incorporating the gravitational sweeping mechanism in order to evaluate its significance. In addition, we are presently performing further experiments using a thicker silver single-crystal sample which should shed light on this question. The search for the M.E. in ultra-narrow gamma-ray transitions (lifetimes on the order of seconds) is difficult. One of the methods used is based on the increased self-absorption of gamma-rays emitted in a particular direction as the temperature of the sample is lowered. This increase in absorption at low temperature is an indication of the occurrence of the M.E.. There are substantial difficulties, outlined above, associated with this technique because changes in the gamma-ray counting rates as a function of temperature are associated with a number of experimental factors other than the occurrence of the M.E..

49201 (AD-A–222636/3/XAB) **Computer-oriented, multichannel, direct-current, superconducting quantum interference device. Final report, 30 September 1988-31 March 1989.** Drukier, A.K.; Cao, N.; Carroll, K. Applied Research Corp., Landover, MD (USA). May 1989. 56p. Contract F49620-88-C-0142. Source: NTIS, PC A04/MF A01.

We describe the ARC effort leading towards the computer oriented multichannel DC-SQUID system. More specifically, we describe the prototype of lock-in, bipolar preamplifier and flux counter implemented by our team. The results of tests are quoted and show that our CD-SQUID electronics compare favorably with both commercially available BTI-Dynabias and Berkeley readout electronics. More specifically, our system seems to be more user friendly and easier to interface to the computer.

49202 (AD-A–222720/5/XAB) **Limits imposed by spatial hole burning on the single-mode operation of standing-wave laser cavities.** Zayhowski, J.J. Massachusetts Inst. of Tech., Lexington, MA (USA). Lincoln Lab. 15 Apr 1990. 4p. Contract F19628-90-C-0002. (JA–6345). Source: NTIS, PC A01/MF A01.

Pub. in Optics Letters, Vol. 15, No. 8, 431-433(15 Apr 1990).

A simple formula is derived that gives the ratio of the maximum single-longitudinal-mode inversion density for a standing-wave laser in terms of the cavity geometry and well-known material parameters. This formula can be used as a guideline in the design of single-frequency lasers.

49203 (AD-A–223036/5/XAB) **Diode laser-pumped single-mode 1.3-microns Nd: YALO microlaser. Final report.** University of South Florida, Tampa, FL (USA). Aug 1989. 10p. Contract N00014-87-C-2541. Source: NTIS, PC A02/MF A01.

The objective of this program was to investigate the implementation of a tunable single frequency Neodymium YALO laser on the 1.34 microns transition capable of producing several milliwatts of output power. This laser is to be used as a seed source to injection lock a larger Nd: YALO laser. The output from the latter is in turn to be frequency tripled and Raman shifted to match the passband of the Cs atomic vapor filter. Such a system may be suitable for use in submarine laser communication applications.

49204 (AD-A–223075/3/XAB) **High-pulse-energy flashlamp pumpable laser dyes. Interim technical report, 1 October 1989-31 March 1990.** Kauffman, J.M.; Novinski, J. Philadelphia Coll. of Pharmacy and Science, PA (USA). Dept. of Chemistry. 9 Apr 1990. 12p. Contract DAAL03-89-K-0160. Source: NTIS, PC A03/MF A01.

The class of laser dye known as 4PyMPO was given an expanded fluorophor by substitution of a biphenylene for the phenylene group. Neither the derived quaternary salt or zwitterion had a higher extinction coefficient, quantum yield, or bathochromic shift of absorption from that of the parent compound. Replacement of the methoxy M by julolidino was not achieved. In 2-(4′-methoxy-4-biphenyl)-1-propylbenzimidazole, the methanesulfonate acid salt was no higher in quantum yield than the methanesulfonate quat., indicating no steric hindrance to planarity in the excited state. Addition of a phenylene group, again, did not improve the fluorescence properties. A symmetrical version with benzimidazolium ions at both ends is being prepared. Synthesis of a bridged quaterphenyl with stilbenylmethyl groups as potential intramolecular triplet state quenchers is one step from the target molecule. Synthesis of a high-energy dye related to the most effective bridged sexiphenyls known by replacement of benzene rings B and E by furan rings is one step from the target molecule.

49205 (CONF-900944–2) **Design and testing of a high temperature superconducting current lead.** Wu, J.L. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Science and Technology Center); Dederer, J.T.; Eckels, P.W.; Singh, S.K.; Hull, J.R.; Poeppel, R.B.; Youngdahl, C.A.; Singh, J.P.; Lanagan, M.T.; Balachandran, U. Argonne National Lab., IL (USA). [1990]. 20p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From Applied superconductivity conference; Aspen, CO (USA); 24-28 Sep 1990. Order Number DE90017812. Source: NTIS, PC A03/MF A01 - OSTI.

High critical temperature and low thermal conductivity of the ceramic superconductor Y-Ba-Cu-O were utilized to reduce the Joule heating and the heat leak in a vapor cooled current lead design of nominally 1 kA capacity. The lead consists of a lower superconducting part and an upper normal metal (copper) part. The superconducting part is an assembly of twenty rectangular bars fabricated from a composite of Y-Ba-Cu-O and Ag (15% vol). This part is designed to operate below the critical temperature of the ceramic superconductor. The copper part, consisting of twenty copper wires, extends outside of the cryostat and interfaces to the room temperature power supply. The lead was successfully tested for currents of up to 2 kA. At the optimum operating currents of 1.7-1.8 kA, the helium boil-off measurements show a heat leak reduction of approximately 40% from the conventional designs. Details of the design, fabrication issues and the testing are presented. 9 refs., 8 figs., 1 tab.

49206 (CONF-9009174–2) **Laser applications for high-T_c superconductors.** Chen, C.H.; Phillips, R.C.; McCann, M.P. Oak Ridge National Lab., TN (USA). [1990]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 5. international symposium on resonance ionization spectroscopy and its applications; Varese (Italy); 16-21 Sep 1990. Order Number DE90017743. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Laser ablation and resonance ionization have been used to monitor superconductive film preparation. From the desorption spectra, trapped O_2 in high-$T_c$superconductors was found to play an important role in superconductivity.

49207 (IYaF–88-22) **Information plates TP, δT and T2A for the KLYuKVA data collection system.** Aul'chenko, V.M.; Bajbusinov, B.O.; Titov, V.M. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 14p. (In Russian). Order Number DE91602604. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Several types of information plates designed for operation as part of specialized systems of data collection their functional circuits and basic operating characteristics are described. Plate TP is a 16-channel time-to digital converter of direct counting, its measuring range making up 4095 channels in the inlet signal duration measuring mode, and the minimal measurement discrete is 2ns. Plate δT is a start-stopping time-to-digital converter designed for measuring time correction occuring in the end of channel counting. Measurement range of this plate makes up 5-25ns and conversion discrete (the channel value) equals to 100 ns/channel. Plate T2A is designed for processing signals from drift chambers. Each of four inlet channels contains a time channel for measuring drift time and two amplitude channels for measuring charges from the ends of wires. Maximum charge conversion time makes up 32 μs, the channel value -9x10^{-13} C/channel. 5 refs.; 6 figs.; 3 tabs.

49208 (IYaF–88-104) **Interface for the local net B0612.** Kargal'tsev, V.V.; Repkov, A.V. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 28p. (In Russian). Order Number DE91602603. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Interface allowing one to organize a fast-operating duplex communication channel with sequential data transmission between two processors, is described. Message format and exchange protocol in communication line are presented. Interface device and some structural features allowing one to automate its adjustment and testing, are briefly described. Interface is produced in the CAMAC standard. An option of local computing net for large-scale electrophysical device monitoring, is proposed. The net topology is star-like. 6 figs.

49209 (KCP–613-4404) **Ion chromatography in the manufacture of multilayer circuit boards.** Smith, R.E. Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div. Sep 1990. 27p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00613. (CONF-9009247–1: International ion chromatography symposium, San Diego, CA (USA), 30 Sep - 3 oct 1990). Order Number DE90017647. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Ion chromatography (IC) has proven useful in analyzing chemical solutions used in the manufacture of multilayer circuit boards. The manufacturing process is described briefly and previously published IC methods are reviewed. Then, methods are described for determining chlorate and chlorite in a brown oxide solution; salicylic acid in an epoxy cure agent; formate, sulfate, and tartrate in an electroless copper bath; anionic detergents in a tin-lead brightener and in a cleaning solution; and aqueous photoresist and nonionic brightener in a tin-lead bath. Anion exchange, reverse phase HPLC on a poly(styrene/divinylbenzene), PS/DVB, column and two-dimensional liquid chromatography also are described. Chemically suppressed conductivity and photometric detection are used. 13 refs., 10 figs., 1 tab.

49210 (LBL–26455, pp. 223) **Proximity effect.** Kresin, V.Z. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A proximity system containing a high-T_c superconductor can be used to strengthen the field effect. The use of the proximity contact S_h-Nb in the Josephson junction S_h-Nb-InAs-Nb-S_h (where S_h is a high-T_c film) is promising from the point of view of making a three-terminal device. The proximity effect can also be used to increase the values of the parameters of a conventional superconductor, such as T_c, critical field, and critical current.

49211 (N–90-24586, pp. 3-19) **Pulsed-discharge carbon dioxide lasers.** Willetts, D.V. National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center. Jun 1990. (NASA-CP–3076;L–16797;NAS–1.55:3076;CONF-8910449–: Low-temperature co-oxidation catalysts for long-life CO2 lasers, Hampton, VA (USA), 17 Oct 1989). In *Low-Temperature CO-Oxidation Catalysts for Long-Life CO_2 Lasers.* Source: NTIS, PC A18/MF A03.

The purpose is to attempt a general introduction to pulsed carbon dioxide lasers of the kind used or proposed for laser radar applications. Laser physics is an excellent example of a cross-disciplinary topic, and the molecular spectroscopy, energy transfer, and plasma kinetics of the devices are explored. The concept of stimulated emission and population inversions is introduced, leading on to the molecular spectroscopy of the CO_2 molecule. This is followed by a consideration of electron-impact pumping, and the pertinent energy transfer and relaxation processes which go on. Since the devices are plasma pumped, it is necessary to introduce a complex subject, but this is restricted to appropriate physics of glow discharges. Examples of representative devices are shown. The implications of the foregoing to plasma chemistry and gas life are discussed.

49212 (N–90-24586, pp. 369-378) **A compact, rugged, high repetition rate CO_2 laser incorporating catalyst.** Schwarzenberger, P.M.; Matzangou, X. National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center. Jun 1990. (NASA-CP–3076;L–16797;NAS–1.55:3076;CONF-8910449–: Low-temperature co-oxidation catalysts for long-life CO2 lasers, Hampton, VA (USA), 17 Oct 1989). In *Low-Temperature CO-Oxidation Catalysts for Long-Life CO_2 Lasers*. Source: NTIS, PC A18/MF A03.

The principal design features and operating characteristics of a high repetition rate CO_2 laser are outlined. The laser is a compact, rugged unit, completely sealed and incorporating an unheated solid catalyst. Stable operation has been successfully demonstrated over a temperature range of -35 C to 65 C.

49213 (N–90-24586, pp. 359-368) **The e-beam sustained CO_2 laser amplifier.** Brown, M.J.; Shaw, S.R.; Evans, M.H.; Smith, I.M.; Holman, W. National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center. Jun 1990. (NASA-CP–3076;L–16797;NAS–1.55:3076;CONF-8910449–: Low-temperature co-oxidation catalysts for long-life CO2 lasers, Hampton, VA (USA), 17 Oct 1989). In *Low-Temperature CO-Oxidation Catalysts for Long-Life CO_2 Lasers*. Source: NTIS, PC A18/MF A03.

The design features of an e-beam sustained CO_2 amplifier are described. The amplifier is designed specifically as a catalyst testbed to study the performance of room temperature precious metal CO-oxidation catalysts under e-beam sustained operation. The amplifier has been designed to provide pulse durations of 30 microseconds in a discharge volume of 2 litres. With a gas flow velocity of 2 metres per second, operation at repetition rates of 10 Hz is accommodated. The system is designed for sealed-off operation and a catalyst bed is housed in the gas circulation system downstream from the discharge region. CO and oxygen monitors are used for diagnosis of gas composition in the amplifier so that catalyst performance can be monitored in situ during sealed lifetests.

49214 (PB–90-251422/XAB) **Key technologies of superconducting generator.** Maki, N.; Yamaguchi, K. Hitachi Ltd., Tokyo (Japan). ©Feb 1990. 7p. Source: NTIS, PC A05/MF A01.

Included in Hitachi Review, Vol. 39, No. 1, 25-30(Feb 1990).

A superconducting AC generator (SCG) is expected to be the next advancement of turbine generators, and plans for a 200-MW class generator are being carried out in Japan. Elsewhere, a 120/400-MVA generator in West Germany and a 300-MW generator in the Soviet Union are under development. In the SCG, a cryogenic multi-cylindrical rotor and the airgap winding stator, which differ significantly from the conventional ones, are used. Accordingly, it is necessary to verify the operational characteristics and reliability of the SCG for practical applications. To this end, a 50-MVA generator was manufactured and tested. Major technical problems were identified and solutions were proposed for the design of a larger scale generator. Furthermore, the structure, merits and technical problems of future SCGs using high-T(c) superconductors are discussed. The development of superconductors, which have almost the same B-J(c) performance as the low-T(c) superconductors, appears to be the most suitable target for future work.

49215 (PB–90-251430/XAB) **Field-effect superconducting transistor.** Nishino, T.; Yagi, K.; Kawabe, U. Hitachi Ltd., Tokyo (Japan). ©Feb 1990. 7p. Source: NTIS, PC A05/MF A01.

Included in Hitachi Review, Vol. 39, No. 1, 35-40(Feb 1990).

The operating principle and characteristics of a field-effect superconducting transistor using superconductors and a semiconductor were studied. For the application of superconducting materials to electronics, it is necessary to develop a superconducting transistor, i.e. a superconducting device with a transistor-type structure. In this study, a superconducting transistor was realized and superconducting current was controlled by the application of control voltage. The principle behind this device is the control of the superconducting wave functions and is different from that of conventional semiconductor transistors. It is expected to be a superconducting device of high switching speed and low power dissipation.

49216 (PB–90-255480/XAB) **Review of free-electron lasers.** Roberson, C.W.; Sprnagle, P. Naval Research Lab., Washington, DC (USA). 1990. 151p. Source: NTIS, PC A08/MF A01.

Free-electron laser (FEL) theory and experiments are reviewed. The physical mechanism responsible for the generation of coherent radiation in the FEL is described and the fundamental role of the ponderomotive wave in bunching and trapping the beam is emphasized. The relationship of the FEL interaction to the beam-plasma interaction is pointed out. Various FEL operating regimes are discussed; these include the high-gain Compton and Raman regimes, both with and without an axial guiding magnetic field. The linear and nonlinear regimes are examined in detail, with particular emphasis on techniques for achieving efficiency enhancement. The quality of the electron beam used to drive FELs is a critical factor in determining the gain and efficiency. The subject of electron beam quality, for different accelerators, is discussed. Key proof-of-principle experiments for FELs in an axial guiding magnetic field, as well as those driven by induction linacs, rf linacs, electrostatic accelerators and storage rings are reviewed. Finally, the requirements on wigglers and resonators are discussed.

49217 (SAND–90-0650C) **Development of hermetic microminiature connectors.** Neilsen, M.K.; Andrews, L.A.; Monroe, S.L.; McCollister, H.L. Sandia National Labs., Albuquerque, NM (USA). [1990]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901109–16: International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers, Dallas, TX (USA), 25-30 Nov 1990). Order Number DE90015562. Source: NTIS, PC A02/MF A01 - OSTI.

Miniaturization of hermetic packages has provided the incentive to develop a new family of hermetic microminiature connectors. Microminiature connectors, with a pin spacing of 1.27 mm, have previously been available only in the non-hermetic form. New microminiature connectors with compression seal materials, 304 Stainless Steel housings, Alloy 52 pins, and TM-9 Glass insulators, were examined because compression seals are currently used in larger hermetic connectors and are typically designed to create a residual compressive stress state in the insulator during manufacture. The new microminiature connectors with compression seals were evaluated analytically with two- and three-dimensional finite element models and experimentally by fabrication of prototype connectors. The finite element analyses predicted the development of undesirable tensile stress in the insulator during manufacture and identified the mechanism responsible for the generation of tensile stress in the glass. The experimental investigation confirmed the existence of desirable tensile stress in the glass with the observation of crack development during manufacture. Since the design requirements would not allow the geometric modifications needed to manufacture crack-free connectors with compression seals, insulator materials that generate a matched seal with 304 Stainless Steel housings were developed. Connectors with these matched seals were successfully manufactured. 5 refs., 11 figs., 1 tab.

49218 (SAND–90-0688C) **Thermal stresses in layered electrical assemblies bonded with solder.** Morgan, H.S. Sandia National Labs., Albuquerque, NM (USA). [1990]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901109–17: International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers, Dallas, TX (USA), 25-30 Nov 1990). Order Number DE90015563. Source: NTIS, PC A02/MF A01 - OSTI.

Thermal stresses in a layered electrical assembly joined with solder are computed with plane strain, generalized plane strain, and three-dimensional (3D) finite element models to assess the accuracy of the two-dimensional (2D) modeling assumptions. Cases in which the solder is treated as an elastic and as a creeping material are considered. Comparison of the various solutions shows that away from the corners, the generalized plane strain model produces residual stresses that are identical to those computed with the 3D model. Although the generalized plane strain model cannot capture corner stresses, the maximum stresses computed with this 2D model are, for the mesh discretization used, within 12% of the corner stresses computed with the 3D model when the solder is

modeled elastically and within 5% when the solder is modeled as a creeping material. Plane strain is not a valid assumption for predicting thermal stresses, especially when creep of the solder is modeled. The effect of cooling rate on the residual stresses computed with creep models is illustrated. 6 refs., 12 figs., 1 tab.

49219 (UCRL-CR–104589) **Compact representation of radiation patterns using spherical mode expansions: Final report.** Simpson, T.L. (South Carolina Univ., Columbia, SC (USA). Dept. of Electrical and Computer Engineering); Chen, Yinchao. Lawrence Livermore National Lab., CA (USA); South Carolina Univ., Columbia, SC (USA). Dept. of Electrical and Computer Engineering. 15 Jul 1990. 39p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE91000019. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report presents the results of an investigation of SM (Spherical Mode) expansions as a compact and efficient alternative to the use of current distributions for generating radiation patterns. The study included three areas: (1) SM expansion from the radiation pattern; (2) SM expansion from the antenna current; and (3) Literature search. SM expansions were obtained from radiation patterns during the initial phase of this study. Although straightforward in principal, however, this technique was found to be awkward for the treatment on theoretical radiation patterns. It is included here for completeness and for possible use to summarize experimental results in a more meaningful way than with an exhaustive display of amplitude with azimuth and elevation angles. In essence, the work in this area served as as warm-up problem to develop our skills in computing and manipulating spherical modes as mathematical entities. 6 refs., 21 figs., 6 tabs.

49220 (UCRL-JC–103328) **A hybrid pulse forming technique.** Cravey, W.R. (Lawrence Livermore National Lab., CA (USA)); Portnoy, W.M.; Burkes, T.R. Lawrence Livermore National Lab., CA (USA). [1990]. 9p. Sponsored by Texas Technological University. DOE Contract W-7405-ENG-48. (CONF-9006176–15: 19. power modulator symposium, San Diego, CA (USA), Jun 1990). Order Number DE90016860. Source: NTIS, PC A02/MF A01 - OSTI.

Circuits for producing high power pulses with fast risetimes involve either charged transmission lines or pulse forming networks, depending on the width of the required pulse. In general, very fast risetimes can be obtained only with transmission lines, which are not practical for pulses wider than a few microseconds because of the excessive lengths of line required. Wider pulses can be obtained with a PFN, but a fast risetime mandates many stages, which may also be impractical. The work described here examined a pulse forming technique which incorporates the advantages of both the T-Line and the PFN: the combined or hybrid circuit. Both series and parallel arrangements were theoretically and experimentally investigated, and the qualities of and problems with each were identified. As expected, discontinuities were observed for each arrangement, but their effect could be reduced by insertion of appropriate additional elements at the junction of the T-Line and the PFN; this type of filtering was found to be more successful with a parallel hybrid. 7 refs., 13 figs., 1 tab.

49221 **SQUIDs: Principles, noise and application.** Clarke, J. (Lawrence Berkeley Lab., CA (USA). Materials and Chemical Sciences Div.). pp. 51-99 of Superconducting devices. Ruggiero, S.T.; Rudman, D.A. Academic Press Inc., San Diego, CA (USA) (1990). DOE Contract W-7405-ENG-48.

This paper presents an overview of the current status of dc and rf SQUIDs. The versatility of these devices is presented. Commercial production of the rf SQUID is addressed.

49222 **Integrating and enhancing tool for ASIC design using MOSIS fabrication.** Newport, D.F. (Tennessee Univ., Knoxville, TN (USA). Dept. of Electrical and Computer Engineering); Bouldin, D.W.; Britton, C.L. Jr.; Alley, G.T.; Bryan, W.L.; Emery, M.S.; Ericson, M.N.; Brashear, H.R. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA)*, 37(2): 370-373 (Apr 1990). DOE Contract AC05-84OR21400. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

Application-specific integrated circuits (ASICs), which have traditionally been cost-effective only for high volume applications, can now be designed using high quality, inexpensive tools and can be fabricated in small quantities using MOSIS (metal oxide semiconductor implementation service). Numerous computer-aided design tools developed under government sponsorship are available to organizations within the United States for just a media handling fee. The tool integration and enhancement activities described in this paper have resulted in proven set of high quality aids that permit the design of custom and semicustom analog and digital ASICs. Examples of projects implemented using this tool set are given along with the support activities that are being conducted to transfer this technology to other federal agencies and universities.

43 PARTICLE ACCELERATORS

Refer also to citation(s) 49565, 49887

4301 Design, Development, and Operation

Refer also to citation(s) 49239

49223 (AD-A–223047/2/XAB) **Experimental study of the plasma-focus device as a charged-particle accelerator. Final report, October 1982-May 1985.** Schneider, R.E. Naval Surface Warfare Center, Silver Spring, MD (USA). 1 Nov 1988. 124p. (NSWC-TR–88-394). Source: NTIS, PC A06/MF A01.

The dense plasma focus has been investigated at many laboratories as a possible fusion device. Typical plasma parameters for this device are electron temperatures of 1 keV, densities of 10 to the 19th power per cc, and confinement times of 100 ns. Characteristic of the plasma focus discharge are intense soft and hard x-ray, optical and microwave radiations. Also, emitted from the focus are electrons, ions and, with certain filling gases, neutrons. The emphasis of this work is to investigate the electron and ion emission from the plasma focus and the development of appropriate diagnostics to accomplish this task. The viewpoint of the focus as a bipolar diode may provide a natural description of the observed phenomena. A Mather geometry plasma focus device has been constructed. Diagnostics used for electron measurements include current monitors, a calorimeter, a magnetic energy analyzer, and an emittance meter. Ion beam measurements were performed using a flux-meter, a pinhole camera, an ion beam emittance meter, and a Thomson parabola analyzer. In addition, opening switch behavior has been investigated. Intense electron beams are observed with pulse lengths approximately 5 ns at energies of 20 to 200 keV and currents of 1 kA and above. The root-mean-square (rms) emittance of the electron beam is found to be approximately 1 cm-rad. Ion measurements show copious ion emission of very energetic ions up to several MeV. A measurement of rms emittance of the ion beam was made. Results support the bipolar diode model of the plasma focus device.

49224 (ANL/APS-CP–3) **Proceedings of the third users meeting for the Advanced Photon Source.** Argonne National Lab., IL (USA). Advanced Photon Source Div. Jun 1990. 300p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-8910450–: 3. users meeting for the advanced photon source (APS), Argonne, IL (USA), 12-13 Oct 1989). Order Number DE90018030. Source: NTIS, PC A13/MF A01; OSTI; INIS; GPO Dep.

The Third Users Meetings for the Advanced Photon Source, held on October 12–13, 1989, at Argonne National Laboratory, brought together scientists and engineers from industry, universities, and national laboratories to review the status of the facility and make plans for its use. The presentations documented in these proceedings include overviews of the project status and the user access policy; updates on several fundamental research efforts that make use of synchrotron radiation; reports on insertion-device R&D and beam line design activities; cost and manpower estimates for beam line construction; and a panel discussion on strategies for developing and managing Collaborative Access Teams. The actions taken at the 1989 Business Meeting of the Advanced Photon Source Users Organization are also documented.

49225 (BNL–43923) **Operational status of the Brookhaven National Laboratory Accelerator Test Facility.** Batchelor, K. (Brookhaven National Lab., Upton, NY (USA)); Ben-Zvi, I.; Fernow, R.C.; Fischer, A.S.; Gallardo, J.; Jialin, Xie; Kirk, H.G.; Malone, R.G.; Parsa, Z.; Palmer, R.B.; Rao, T.; Rogers, J.; Sheehan, J.; Tsang, T.Y.F.; Ulc, S.; van Steenbergen, A.Brookhaven National Lab., Upton, NY (USA). [1990]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900603–34: 2. European particle accelerator conference, Nice (France), 11-16 Jun 1990). Order Number DE90017631. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Initial design parameters and early operational results of a 50 MeV high brightness electron linear accelerator are described. The system utilizes a radio frequency electron gun operating at a frequency of 2.856 GHz and a nominal output energy of 4.5 MeV followed by two, $2\pi/3$ mode, disc loaded, traveling wave accelerating sections. The gun cathode is photo excited with short (6 psec) laser pulses giving design peak currents of a few hundred amperes. The system will be utilized to carry out infra-red FEL studies and investigation of new high gradient accelerating structures.

49226 **Advanced accelerator concepts.** AIP Conference Proceedings 193. Joshi, Chan (ed.) (California Univ., Los Angeles, CA (USA)). 489p. American Institute of Physics, New York, NY (USA) (1989). Sponsored by University of California; U.S. DOE Energy Research. From Workshop on advanced accelerator concepts; Lake Arrowhead, CA (USA); 9-13 Jan 1989.

The 1989 Workshop, on "Advanced Accelerator Concepts," was held at the UCLA Bruinwood Conference Center at Lake Arrowhead, California from January 9–13, 1989. This conference proceedings contains most of the invited presentations and contributed papers by the attendees. The conference addressed the following topics: Plasma based accelerator concepts and use of plasmas in future high energy accelerators, wake-field devices, radio frequency acceleration and sources, optical frequency acceleration, high brightness sources, and other novel methods for particle acceleration. The Workshop and these proceedings were supported by the Office of Energy Research of the US Department of Energy and UCLA.

49227 (DOE/ER–0463P) **Report of the Department of Energy (DOE) Office of Energy Research Review Committee on the site-specific conceptual design of the Superconducting Super Collider.** USDOE Office of Energy Research, Washington, DC (USA). Office of Superconducting Super Collider. Sep 1990. 320p. Sponsored by U.S. DOE Energy Research. Order Number DE90018021. Source: NTIS, PC A14/MF A01; OSTI; INIS; GPO Dep.

After it was established in early 1989, the Superconducting Super Collider Laboratory (SSCL) began to prepare a detailed site-specific SSC conceptual design, including cost and schedule estimates. As detailed in the SSC Site-Specific Conceptual Design Report (SCDR), this design builds upon the design in the March 1986 SSC Conceptual Design Report (CDR) and takes into account characteristics of the SSC site, results of continuing magnet R&D, and advances in accelerator design.

49228 (FEI–1946) **FEhl pulse spectrometric neutron generator.** Bashmakov, V.S. (and others); Glotov, A.I.; Kozlov, V.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst. 1988. 8p. (In Russian). Order Number DE91602252. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Pulse neutron generator with subnanosecond, micro- and millisecong pulse durations is being developed in FEhl to conduct spectrometric neutron-physical investigations. Generator design allows to form pulse milliampere ion beams. Description of some systems of generator is presented, and their performances are given. 2 refs.

49229 (JINR–9-89-118) **JINR synchrophasotron: Operation and improvement (quarters 1,2,1988).** Balandikov, A.N. (and others); Vasilishin, B.V.; Volkov, V.I. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. 1989. 7p. (In Russian). Order Number DE91602254. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Information on the operation of the accelerator in Quarters 1 and 2, 1988 is presented. Accelerated beams of protons, polarized deuterons and He nuclei were used in physics experiments. A high stability of the accelerator operation allowed five physics experiments to be performed simultaneously. The investigations of the factors which give rise to the modulation of the current of an extracted beam in the first direction are being continued. In order to increase the efficiency of beam extraction in the second direction, theoretical calculations and design developments were made. During the summer stop of the accelerator some part of the trace of the extracted beam was shimmed to compensate the defocusing action of the edge magnetic field of the accelerator. 2 refs.; 6 figs.; 1 tab.

4302 Beam Dynamics, Field Calculations, and Ion Optics

Refer also to citation(s) 49267, 49272, 49893, 50174, 50202

49230 (BNL–45013) **The new conceptual design of snakes and spin rotators in RHIC.** Lee, S.Y.; Courant, E.D. Brookhaven National Lab., Upton, NY (USA). [1990]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900924–2: 9. international symposium on high energy spin-physics, Bonn (Germany, F.R.), 10-15 Sep 1990). Order Number DE90017636. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We discuss the generalized snake configurations, which offers either the advantages of shorter total snake length and smaller horizontal orbit displacement in the compact configuration or the dual functions of a snake and a 90° spin rotation for the helicity state. The generalized snake is then applied to the polarized proton collision in RHIC. The possible schemes of obtaining high luminosity are discussed.

49231 (EFI–1013(63)-87) **On the possibility of oscillation damping in strong-focusing accelerator by spontaneous radiation.** Tumanyan, R.V. Erevanskij Fizicheskij Inst., Erevan (USSR). 1987. 10p. (In Russian). Order Number DE91602257. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The possibility of oscillation damping in strong-focusing accelerator (with combined function magnets) by means of additional source of spontaneous radiation is considered. The decrement of radiation damping of oscillations is calculated and the conditions of damping imposed on the radiation source parameters are given. It is shown that damping by an ondulator is possible at low periods of the latter, and by a wiggler -at high magnetic field induction. 9 refs.

49232 (FRCEA-TH–209) **The transverse displacement in a circular accelerator disturbs the hexapolar non-linearities. Application to the dynamical aperture problem.** Audy, P. Paris-11 Univ., 91 - Orsay (France); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Fondamentale (IRF). 1989. 143p. (In French). Order Number DE91700556. Source: NTIS (US Sales Only), PC A07/MF A01.

An analytical and numerical approach for improving the dynamical aperture of a given circular accelerator facility is presented. In circular accelerators, powerful nonlinear lenses (hexapoles) are used, in order to balance the optic structure natural chromaticity. The nonlinearity disturbes the particle's transverse displacement and restricts the phase space stability range (dynamical aperture). The proposed approach consists, basically, in calculating physical values involving the hexapolar disturbances. These ones are evaluated and minimized in an optimization program, which allows the stability range to be enlarged. Numerical calculations involving a low beam emittance synchrotron radiation source are performed and the approach validity is proven.

49233 (ITEF–110-89) **Floquet functions in accelerating-focusing channel with an arbitrary structure of a period.** Balabin, A.I.; Ugarov, S.B. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1989. 12p. (In Russian). Order Number DE91602268. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Based on smooth approach to motion equation solution the general formulas for Floquet functions in accelerating-focusing channel

comprising a sequence of thin lenses with arbitrary period structure are derived. Application of the results obtained for calculating particle motion stability in accelerating structures with HF-focusing is considered. It is shown that in this case general equations transfer to certain ratios, true for particular structures. 8 refs.; 5 figs.

49234 (ITEF–169-88) **Increase of strip beam emittance in linear focusing systems.** Zenkevich, P.R.; Korolev, A.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1988. 20p. (In Russian). Order Number DE91602269. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The time dependence of strip beam emittance coulomb increase in arbitrary linear focusing systems is analytically considered. Within the framework of an entirely self-consistent theory the precise dependence on time of laminar flux emittance increase is obtained. The nonlaminar beam emittance increase is studied using the perturbation method which does not take into account the changes in the form of density distribution in the process of particle oscillations. It is shown that the results of both theories coincide for the initial sections of focusing channels. 8 refs.

49235 (KFTI–88-19) **Integral equations for elastic wave scattering on non-uniformities in anisotropic media.** Zabela, A.G.; Nikolajchuk, L.I.; Prokhorenko, E.M.; Khizhnyak, N.A. AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst. 1988. 7p. (In Russian). Order Number DE91602270. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Integral equations equivalent to differential equations of boundary problem describing elastic wave scattering on non-uniformity in unbounded anisotropic medium are derived. The Green function in the integral form containing three waves is obtained. Static case when Green function is of known form is studied in detail. An integral equation is derived which for the points inside non-uniformity defines the displacement field directly through the displacement field existing before non-uniformity introduction and for the points outside non-uniformity this equation is reduced to the ratio defining sum displacement field through the initial (before non-uniformity introduction) one and displacement field inside non-uniformity. 4 refs.

49236 (LBL–28189) **On the beam impedance of shallow tapered cavities.** Jacob, A.F.; Lambertson, G.R.; Voelker, F. Lawrence Berkeley Lab., CA (USA). Jun 1990. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-900603–36: 2. European particle accelerator conference, Nice (France), 11-16 Jun 1990). Order Number DE91000249. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A local enlargement of a beam tube may support high-Q resonances just below the cutoff frequency of the first TM-mode. We have investigated the longitudinal beam impedance of such cavities that have gradual changes in pipe radius. For convenience, circular cross sections and linear tapers were assumed in the analysis. Several methods with different approximations have been compared. The calculations gave values for the stored energy and the Q-factor which agreed well, while the numbers obtained for Z_B exhibit some variation, but remain very small.

49237 (UCRL-JC–103797) **Modified-Yee field solutions in the AMOS wakefield code.** Shang, C.C.; DeFord, J.F. Lawrence Livermore National Lab., CA (USA). 29 Aug 1990. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9009123–5: Linear accelerator conference, Albuquerque, NM (USA), 9-14 Sep 1990). Order Number DE91000258. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A new numerical procedure by which field calculations in AMOS are upgraded to model rotationally symmetric cavity structures in a more accurate fashion is described. The development work is aimed at implementing a modified finite difference update scheme on an irregular grid system. Elements of an irregular grid may be chosen to better fit object boundaries, resulting in increased solution accuracy. Our approach involves the placement of field components on a non-orthogonal body fitting grid and on a dual grid which is orthogonal to the first grid. It is found that this procedure retains several important computational advantages, including the ability to exploit the implied spatial relationships between nodes. Propagating fields on an irregular grid system have been observed and comparisons between finite difference AMOS and Modified-Yee AMOS field calculations are provided.

49238 (UCRL-JC–103825) **Use of a FEL [free electron laser] as a buncher for a TBA [two-beam accelerator] scheme.** Shay, H.D.; Jong, R.A.; Ryne, R.D.; Scharlemann, E.T.; Yu, S.S. Lawrence Livermore National Lab., CA (USA). 10 Sep 1990. 20p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9009166–3: 12. international free electron laser conference (FEL-12), Paris (France), 17-21 Sep 1990). Order Number DE91000253. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

S. S. Yu has proposed an alternate injector for the drive beam. A linear induction accelerator (LIA) produces a beam of several kA, having an energy more than 10 MeV, and with a pulse length about 12 ns long. This beam energizes a 29 GHz rf FEL amplifier. The exiting beam is well modulated at 29 GHz and is then chopped in a subharmonic transverse chopper at 352 MHz. The resulting pulse has the requisite temporal format for the drive beam and is subsequently accelerated by means of the LEP 352 MHz cavities to several GeV. One additional requirement is demanded of the low energy drive beam: it must have small energy spread, less than about 10%, lest the beam become debunched or lost through chromatic aberrations in the low energy magnetic optics prior to acceleration to several GeV. This paper examines Yu's concept. In Section 2, the FEL performance is explored. Questions of the design of the subharmonic buncher and debunching of the beam subsequent to exiting from the FEL are considered in Section 3. Sections 4 contains the conclusions and suggestions for future directions.

4303 Auxiliaries and Components

Refer also to citation(s) 49283, 49320, 49322, 49324, 49329, 49338, 49341, 49345, 49358, 49359, 49372, 49373, 49374

49239 (BNL–44625) **The BNL 200 MeV H^- linac: Performance and upgrades.** Alessi, J.G.; Brennan, J.M.; Kponou, A.; LoDestro, V.; Montemurro, P.A. Brookhaven National Lab., Upton, NY (USA). [1990]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9009200–13: 1990 LINAC conference, Albuquerque, NM (USA), 10-14 Sep 1990). Order Number DE91000119. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

For the past two years the linac has had reliable operation from the new RFQ preinjector. The performance of this preinjector is described. There is a fast beam chopper in the transport line between the ion source and RFQ. By injecting narrow pulses into the AGS we can obtain an accurate linac energy measurement, or the detailed shape of the linac beam energy distribution, on a single pulse. Some general comment on the linac operation are also presented.

49240 (CONF-9009123–2) **ECR [electron cyclotron resonance] ion sources and applications with heavy-ion linacs.** Pardo, R.C. Argonne National Lab., IL (USA). [1990]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Linear accelerator conference; Albuquerque, NM (USA); 9-14 Sep 1990. Order Number DE90017694. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The electron cyclotron resonance (ECR) ion source has been developed in the last few years into a reliable source of high charge-state heavy ions. The availability of heavy ions with relatively large charge-to-mass ratios (0.1–0.5) has made it possible to contemplate essentially new classes of heavy-ion linear accelerators. In this talk, I shall review the state-of-the-art in ECR source performance and describe some of the implications this performance level has for heavy-ion linear accelerator design. The present linear accelerator projects using ECR ion sources will be noted and the performance requirements of the ECR source for these projects will be reviewed. 30 refs., 3 figs.

49241 (CONF-9009123–3) **A very wide bandwidth Faraday cup suitable for measuring gigahertz structure on ion beams with velocities down to $\beta < 0.01$.** Bogaty, J.M.; Pardo, R.C.; Clifft, B.E. Argonne National Lab., IL (USA). [1990]. 4p. Sponsored

by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Linear accelerator conference; Albuquerque, NM (USA); 9-14 Sep 1990. Order Number DE90017819. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A stripline Faraday Cup of exceptional bandwidth (DC to 6.1 gigahertz) has been developed. An electrostatic shield in the ground-plane geometry prevents electric-field coupling of incoming ions so that the time distribution of low-velocity ($\beta \gtrsim .01c$) particles can be measured. The cup is very rugged compared to other detectors used for ion-bunch timing measurements. We have measured bunch widths of 400 picoseconds on 3.9 MeV $^{84}Kr^{+15}$ beams (200 nanoampere average). Bunch widths down to 100 picoseconds should be observable with a sampling oscilloscope. Beam bunch shapes have been monitored at current levels of 1.0 nanoampere to 10 microampere average.

49242 (CRN-VIV–64) **The main aspects of the Vivitron mechanical structure.** Gaudiot, G.; Koenig, R.; Esteve, T.; Peter, R.; Strebel, A. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. May 1989. 7p. (CONF-8905141–: 5. international conference on electrostatic accelerators and associated boosters, Strasbourg (France), 24-27 May 1989). Order Number DE91700564. Source: NTIS (US Sales Only), PC A02/MF A01.

The main aspects of the Vivitron mechanical structure are discussed through a description of the tank and the internal structure. The results of the calculated constraints on the structure are presented.

49243 (EFI–988(38)-87) **Modernization of the VMR-2 monochromator and its use in a synchrotron radiation channel.** Arutyunyan, V.V. (and others); Grigoryan, N.E.; Eritsyan, G.N. Erevanskij Fizicheskij Inst., Erevan (USSR). 1987. 9p. (In Russian). Order Number DE91602316. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

An optical scheme for investigations on spectroscopy of solids in 50-250 nm range is designed and mounted on the channel of synchrotron radiation. The main block of the scheme is the modernized monochromator of normal incidence - VMR-2. By changes in the optical scheme we succeeded in using the monochromator as a double-beam spectrometer, keeping up one of the most important advantages of synchrotron radiation-polarization. The experiment was controlled, the radiation detection and spectrum extraction were automated by means of an Elektronika-60 B computer. 6 refs.; 4 figs.

49244 (EFI–1008(58)-87) **The estimate of the threshold energy of Yerevan synchrotron with a new accelerating system.** Baryshev, A.I. Erevanskij Fizicheskij Inst., Erevan (USSR). 1987. 21p. (In Russian). Order Number DE91602287. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The estimates of the phase and betatron oscillations induced by the radiation quantum fluctuations during the long-term (up to 0.1 s) extraction of permanent-energy particles from the Yerevan synchrotron are given. The equilibrium phase is evaluated with account of damping of radial oscillations and the HF power is calculated which accelerates the beam and is lost in resonators. The threshold energy of the synchrotron at the given duration of extraction and the limiting duration of escape at the given energy for different numbers of resonators of the 466 MHz accelerating system under construction are determined. 4 refs.; 2 figs.; 3 tabs.

49245 (EFI–1018(68)-87) **Experimental set-up for investigation of high-energy electrons scattering and radiation during their channeling in monocrystals.** Avakyan, R.O. (and others); Avakyan, Eh.O.; Avetisyan, A.Eh. Erevanskij Fizicheskij Inst., Erevan (USSR). 1987. 13p. (In Russian). Order Number DE91602315. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

An experimental set-up mounted on the electron arm of the Yerevan synchrotron for investigation of high-energy electron radiation and scattering is described. 7 refs.; 3 figs.

49246 (EFI–1021(71)-87) **Optimization of the shape of the bending magnets cross section for electron accelerators and storage rings.** Akopyan, V.P. (Moskovskij Gosudarstvennyj Univ., Moscow (USSR)); Karabekov, I.P.; Kravtsov, V.D.; Vyrenkova, M.Ya. Erevanskij Fizicheskij Inst., Erevan (USSR). 1987. 18p. Order Number DE91602294. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The optimization criterion and programs of calculations for the choice of the form of the cross section of bending magnet core and the disposition of its windings are worked out. On the basis of these calculations there are obtained the most efficient proportions for the dimensions of the magnet core cross section and windings of the magnets for electron accelerators, storage rings and stretchers. 5 refs.; 6 figs.; 3 tabs.

49247 (EFI–1025(75)-87) **Basic circuit of synchrotron power supply on standard units.** Karabekov, I.P.; Otarov, A.R. Erevanskij Fizicheskij Inst., Erevan (USSR). 1987. 15p. Order Number DE91602295. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Optimization results to produce a power supply system for fast-cycling electrons synchrotrons with separate windings in the magnet blocks for the alternating and direct currents are presented. Such a system allows to create synchrotron power supply circuits using only corresponding industrial units. 6 refs.; 3 figs.

49248 (EFI–1035(85)-87) **Characteristics of the electron beam extracted onto the Deuteron-2 installation in the low background room of the Erevan synchrotron.** Alanakyan, K.V. (and others); Amaryan, M.Dzh.; Asryan, G.A. Erevanskij Fizicheskij Inst., Erevan (USSR). 1987. 13p. (In Russian). Order Number DE91602288. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The description and characteristics are given of the electron beam formed and extracted onto the target of the Deuteron-2 installation for investigation of electron-nucleus processes. One of the most important features of the beam -the duty factor - is investigated in more detail. 4 refs.; 2 figs.; 1 tab.

49249 (FEI–1950) **Study on beam injection systems of the EhGP-10M charge-exchange electrostatic accelerator.** Bashmakov, V.S.; Glotov, A.I.; Kupriyanov, B.V.; Romanov, V.A.; Spirin, V.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst. 1988. 12p. (In Russian). Order Number DE91602289. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Different arrangement of ion-optical injector of the EhGP-10M charge-exchange electrostatic accelerator is considered. The low-voltage injection into accelerating tube with an open input and constant ratio of accelerated and injected beam energies, low-voltage injection into accelerating tube, closed at the input by plane metallic grid, and high-voltage injection. Computerized simulation of beams transport was carried out in microchannel approximation of phase density distribution. SM type computer was used. Experimental characteristics of beam transport through accelerator under different low-voltage injection variants are presented. Analysis of obtained results is given. 5 refs.; 1 tab.

49250 (FNAL-TM–1674) **Mechanical support of superconducting coils.** Bossert, R.C.; Kerby, J.S. Fermi National Accelerator Lab., Batavia, IL (USA). Jul 1990. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-890872–15: Workshop on physics at Fermilab in the 1990's, Breckenridge, CO (USA), 15-24 Aug 1989). Order Number DE90017498. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Cold iron magnets use the iron yoke and skin for mechanical support of the collared coil assembly. A variety of designs, including horizontally and vertically split yokes, "collarless" magnets and conductor block geometries, have been considered for use with collared coils. This note qualitatively compares the support mechanisms by estimating the amount of coil "overcompression" necessary for the magnet to achieve the same mechanical condition in the cold, powdered state. These designs inspect magnet limitations by suggesting means to reduce the peak coil compressive load, allowing higher central magnetic fields to be reached.

49251 (FNAL-TM–1676) **An investigation of thermally driven acoustical oscillations in helium systems.** Fuerst, J.D. Fermi National Accelerator Lab., Batavia, IL (USA). Aug 1990. 6p.

Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-900708–1: Low temperature engineering and cryogenics conference, Southampton (UK), 17-19 Jul 1990). Order Number DE90018049. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The phenomenon of thermal-acoustic oscillation is seen to arise spontaneously in gas columns subjected to steep temperature gradients, particularly in tubes connecting liquid helium reservoirs with the ambient environment. This if often the arrangement for installed cryogenic instrumentation and is accompanied by undesirably large heat transfer rates to the cold region. Experimental data are collected and matched to theoretical predictions of oscillatory behavior; these results are in good agreement with the analytical model and with previously collected data. The present experiment places the open ends of oscillating tubes of the various lengths and cross sections in communication with flowing helium in the subcooled, 2-phase, or superheated state while the other ends are maintained at some controlled, elevated temperature. Assorted cold end conditions are achieved through adjustments to the Fermilab Tevatron satellite test refrigerator to which the test cryostat is connected. The warm, closed ends of the tubes are maintained by isothermal baths of liquid nitrogen, ice water, and boiling water. The method is contrasted to previous arrangements whereby tubes are run from room temperature into or adjacent to a stagnant pool of liquid helium. Additionally, the effect of pulsations in the flowing helium stream is explored through operation of the refrigerator's wet and dry expanders during data collection. These data confirm the theory to which try were compared and support its use in the design of cryogenic sensing lines for avoidance of thermoacoustic oscillation.

49252 (FNAL-TM–1678) **Operation of a 2-phase return dewar in a satellite refrigerator.** Fuerst, J.D. Fermi National Accelerator Lab., Batavia, IL (USA). Aug 1990. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. Order Number DE90018048. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In late 1986 a 100 liter liquid helium phase separator/dewar was designed for use in the Tevatron satellite refrigeration system. Installed on the low pressure return side of the helium circuit between the tunnel return and the exchanger cold end, this vessel was to provide phase separation for a future centrifugal cold compressor installed immediately downstream. Additionally, the vessel by itself would buffer the satellite refrigerator's coldbox from cryogenic system upsets occurring in the tunnel during Tevatron operation. By mid-1988 a prototype had been constructed and approval received to install the 2-phase return dewar in the A1 refrigerator. This paper describes both vessel and refrigerator performance during this test period and draws conclusions with regard to the benefits of such a device in a satellite refrigerator.

49253 (IFVE-OLU–89-86) **The development and tests of high-power Y-circulator of the metre-wave range.** Veryutin, V.A.; Kozhurkin, G.N.; Mazurov, E.V.; Mal'tsev, I.G.; Masaev, A.B.; Nagaev, V.I.; Rubin, A.E.; Stepanov, V.B. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 12p. (In Russian). Order Number DE91602296. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A self-regulation system according to the signal of reflected voltage wave from the accelerator resonator (Y-circulator) is used for compensation of HF-field perturbation by an accelerated beam in the HF-supply system of the main part of accelerator-injector to the booster. To provide for conditions for reflected wave complete signal separation an option of accelerator resonator excitation through nonmutual ferrite devices, particularly through Y-circulator, is proposed. Results of developing and testings of high-power Y-circulator, operating at 148.5 MHz are presented. The following device parameters: VSWR - 1.05-1.15; direct loss - from 0.55 to 1.17 dB; decoupling - 23-25 dB are obtained under the optimal external field of ferrite magnetizing in the range of input HF-power from 0.6 to 3.8 MW. 8 refs.; 6 figs.

49254 (IFVE-OLU–89-97) **Computer calculation of the powerful tube generator for accelerator HF power supply system.** Mal'tsev, I.G.; Nagaev, V.I.; Starovojtov, V.A.; Chernyj, N.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 16p. (In Russian). Order Number DE91602297. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The REGIM computer program for the calculation of the powerful tube generator regimes is described. This program satisfies the wide range of the requirements imposed for the tube generators as HF power supplies of an ion accelerators. 6 refs.; 4 figs.

49255 (IFVE-OLU–89-126) **Amplitude detector.** Slyusarev, V.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 7p. (In Russian). Order Number DE91602317. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Amplitude detector of the 50-400 MHz frequency range has been described. Transition time of the surge characteristic is the 200 ns. Conversion nonlinearity is the 0.5% in the input voltages range of 0.05-5V. Temperature nonstability of conversion coefficients is the 0.023%/deg C. It may be used in fast-acting stabilization systems of the rf-voltage phase and amplitude in the resonators of linear accelerators. 5 refs.; 3 figs.; 1 tab.

49256 (IFVE-OMVT–89-104) **Mathematical model and program for superconducting magnet mechanics study.** Abramov, A.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij); Dajkovskij, A.G.; Ryabov, A.D.; Mustafin, Kh.Kh. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 18p. (In Russian). Order Number DE91602298. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A mathematical model, assigned for the analysis of the SC-magnet mechanical properties is described. Particular attention is paid to the calculation technique and operation of assembly coil package with different types of connection: key, lock, pin. The model allows one to analyse the SC magnet properties already in the course of designing and helps in interpreting experimental data. 15 refs.; 9 figs.; 1 tab.

49257 (ITEF–102-89) **Study on charge exchange and radiation resistance of carbon targets in the I-2 proton linear accelerator.** Lebedev, S.G.; Lebedeva, G.S.; Panchenko, V.N.; Romanovskij, R.A.; Stolbunov, V.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1989. 8p. (In Russian). Order Number DE91602329. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Results of estimated calculations of service lives of carbon targets produced by hydrocarbon gas cracking in smouldering electric charge are presented, data on durability and efficiency of carbon recharging targets on He^+ ion beams are presented, data on the effect of target material and its thickness on ion beam energy parameters are obtained. He_4^{2+} ion current produced as a result of recharging in the carbon film made up 1mA during a two-week operation cycle with a single target. Recharging target efficiency in this case made up 0.97. 15 refs.; 1 fig.

49258 (ITEP–156-88) **Sparking limit of the accelerating gap of the heavy ion accelerator.** Bobylev, A.V. (and others); Zarubin, A.B.; Iosseliani, D.D. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1988. 14p. Order Number DE91602303. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The aim of investigation is to determine the maximum permissible value of the electric field strength in the accelerating structure, of a heavy ion linear accelerator. Sparking limit for metal electrodes made of different materials at about 6 MHz frequency and 10^{-3}-10^{-4} Pa pressure are determined. Electrodes with coatings of Ni and Mo are shown to have the highest values of the sparking voltage. 4 refs.; 8 figs.

49259 (JAERI-M–90-072) **Report of the seminar on nuclear physics and atomic physics at the JAERI tandem-booster accelerator.** Ikezoe, Hiroshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Nagame,

Yuichiro; Sataka, Masao (eds.). Japan Atomic Energy Research Inst., Tokyo (Japan). Apr 1990. 63p. (CONF-8911228–: Tokai (Japan), 6-7 Nov 1989). Order Number DE90520213. Source: NTIS (US Sales Only), PC A04/MF A01.

A meeting on new experimental apparatus which are suitable for Nuclear Physics and Atomic Physics at the JAERI tandem-booster accelerator being under construction was held at Tokai Research Establishment of JAERI in the period from 6 to 7 November, 1989. More than 80 participants from universities and JAERI attended to discuss the following themes: 1. Atomic and Molecular Physics in the energy region of tandem-booster accelerator. 2. Experimental methods and apparatus for nuclear structure study. 3. Experimental methods and apparatus for nuclear reaction study. (author).

49260 (JINR-E–1-89-291) **Monitoring system for relativistic particles and nuclei.** D'yachenko, V.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy); Tolstov, K.D.; Kozma, P.; Damdinsurehn, Ts. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. 1989. 15p. Order Number DE91602330. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Submitted to Nucl. Instrum. Methods.

Technique and results of application of a monitoring system for relativistic particles and nuclei accelerated at the Dubna synchrophasotron are described. The proposed technique allows one to measure a beam of charged projectiles over a wide range of intensities up to the maximum limit without some dependence on the beam profile. The technique was applied to calibrate the systems for measuring the absolute intensity. It made possible determining the total cross sections of monitoring reactions $^{27}Al(p,X)^{24}NA$ AND $^{27}(c,X)^{24}Na$ at 3.65 AGeV with a sufficient accuracy for the beam flux monitoring by the well-known foil activation technique. 13 refs., 7 figs.

49261 (JINR-E–16-89-59) **The high-energy neutron spectrometry in mixed indirectional radiation fields behind accelerator shielding.** Timoshenko, G.N.; Krylov, A.R. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. 1989. 8p. Order Number DE91602331. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Submitted to Radiat. Prot. Dosim.

Some results of high-energy neutron spectrum measurements in different radiation fields outside accelerator shielding are presented. The spectra have been unfolded by the statistical regularization method on data of a deviece intended for measurements of spectra, fluences and equivalent doses of neutrons with energy above 20 MeV in mixed undirectional radiation fields. The high sensitivity of the device allowed obtaining the neutron background spectrum originated from cosmic-rays near earth surface. 9 refs.; 3 figs.

49262 (KEK–89-17, pp. 196-202) **Trigger/front end electronics and data collection.** Ikeda, Hirokazu (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Nov 1989. (In Japanese). (CONF-8910393–: Workshop for asymmetric B-factory at KEK, Tsukuba (Japan), 2-4 Oct 1989). In *Proceedings of the workshop on asymmetric B factory at KEK.* Order Number DE90777869. Source: NTIS (US Sales Only), PC A12/MF A01.

The data collection system in the B factory at KEK is planned to have the features that the beam cross intervals will be small (15-30 necs), that the first-step trigger frequency will be 1 kHz, that the frequency of data transfer from the mass storage will be around 10 Hz, and that the data capacity will be 256 kilobyte/sec at most. A possible approach to meet these requirements is to use a trigger system of a pipeline mechanism, a multiple front end system, a high-speed data scanning module and a large-scale processor farm. The trigger system is intended to extract high-speed signals from the detector and to start and control the entire data collection system. The start signals and control signals should synchronize with the beam cross. The front end electronics comprises high-sensitivity analog electronics, including front amplifier, and an analog/digital converter. The data collection system has a tree structure. Its lowest layer comprises a multiple buffered memory. Required data are extracted by the high-speed data scanning module, stored in a memory incorporated in the scanning module, and then transferred to the processor farm. (N.K.).

49263 (KEK–89-19, pp. 51-61) **ISIS status and prospects, November 1989.** Williams, W.G. (Rutherford Appleton Lab., Chilton (UK)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Dec 1989. (CONF-8911202–: 2. workshop of Japan-UK collaboration on neutron scattering research, Tsukuba (Japan), 1 Nov 1989). In *Proceedings of the second workshop of Japan-UK collaboration on neutron scattering research.* Order Number DE90798861. Source: NTIS (US Sales Only), PC A07/MF A01.

ISIS has easily maintained its position as the most intense operational pulsed neutron source in the world. The report first shows the record of its performance from early 1986 to the present, in terms of integrated current in μA-hr per user cycle. The reliability of ISIS is now such that users expect a daily integrated current in excess of 2000 μA hrs. The main problem for users over the past year was the failure of uranium target 4 in August 1989. A tantalum was installed after the failure, and this will be used for all the remaining cycles in 1989. A new uranium target will be installed during the long shut-down in early 1990. Main new developments on the neutron scattering spectrometers during the past 1-2 years are described, including liquid and amorphous diffractometer, high resolution powder diffractometer, POLARIS (medium resolution, high intensity powder diffractometer), single crystal diffractometer, high energy transfer spectrometer, electron volt spectrometer, and high resolution inelastic spectrometer. Other new instruments include multi-angle rotor instrument, small angle neutron diffractometer for amorphous and liquid samples, and rotating analyzer crystal spectrometer. Some major scientific results are briefly outlined. (N.K.).

49264 (RCNP-P–107, pp. 199-210) **Heavy Ion secondary beam course.** Shimoda, Tadashi (Osaka Univ., Toyonaka (Japan). Coll. of General Education). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8903211–: Workshop on cyclotron cascade project, Ibaraki (Japan), 13-15 Mar 1989). In *Proceedings of the workshop on 'cyclotron cascade project'.* Order Number DE90777870. Source: NTIS (US Sales Only), PC A11/MF A01.

The Cyclotron Cascade Project at Osaka University established a system that accelerates relatively light heavy ion beams in the range of 30-40 MeV per nucleon. These beams permit studies on reactions of heavy ions in the intermediate energy range. In addition, it would also be possible to produce nuclei far away from their stable region with high efficiency, study their characteristics, and examine secondary reactions involving unstable nuclei. A heavy ion secondary beam course is proposed to permit these studies. Design and basic features of the course are outlined. Various nuclei can be produced using these heavy ion beams in the intermediate energy range. With large momenta at the center of gravity, they are emitted forward with relatively uniform energies. So, specific nuclides can be selected and collected efficiently by placing an analyzer in the 0deg direction. In the analyzer, $B\rho$ is determined first and then an energy loss is caused in a thin film, followed by spatial separation of nuclides with a specific A or Z. The major features of the separator (course) at RCNP are that the system has a relatively simple structure, that special optics are adopted to reduce the deterioration in resolution, and that the background level is low. (N.K.).

49265 (TRI-PP–90-25) **Experimental area design for operation at high intensities.** Beveridge, J.L.; Blackmore, E.W.; Hodges, T.A.; Thorson, I.M. British Columbia Univ., Vancouver, BC (Canada). TRIUMF Facility. May 1990. 12p. (CONF-900321–1: 18. INS international symposium on physics with high-intensity hadron accelerators, Tokyo (Japan), 14-16 Mar 1990). Order Number DE90017755. Source: NTIS (US Sales Only), PC A02/MF A01 - OSTI.

After more than a decade of operations at the meson factors (LAMPF, PSI, TRIUMF) there is now considerable experience in the design of experimental areas for energies below 1 GeV and beam powers 1 MW. Solutions have been found for the design of radiation-hard components, vacuum connections, targets and dumps, shielding and remote handling, although there is not always a consensus on the preferred technique. Higher-energy proton accelerators such as the KEK PS, CERN PS and Brookhaven AGS are approaching intensities where radiation damage is a concern but remote handling techniques have not, in general, been necessary. The TRIUMF KOAN Factory with a

planned intensity of 100μA at 30 GeV will require both extensions of meson factory experience and some new techniques to handle the high thermal and radiation levels associated with the 3 MW beam power. This report will describe the important considerations in the design of experimental areas for high-intensity operations.

49266 (UCRL-JC-103783) **Characterization of field errors of layer wound short solenoids.** Nexsen, W.E. Lawrence Livermore National Lab., CA (USA). 10 Aug 1990. 4p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9009200--11: 1990 LINAC conference, Albuquerque, NM (USA), 10-14 Sep 1990). Order Number DE90017527. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We report on a study of the error fields of a set of layer-wound short solenoids of the type used in high-current electron linacs. These error fields are mainly caused by the azimuthal variation of the winding pitch angle. The conventional winding pattern design tends to concentrate the error fields in a dipole component perpendicular to the solenoid axis. Compounding the problem are smaller contributions due to the asymmetric coil feeds and conductor crossovers from one layer to the next. We have constructed and tested a prototype quadrufilar solenodial magnet which utilizes symmetry to cancel the effects of current leads and crossovers and, in the absence of winding errors, should have an intrinsically straight magnetic axis. This design tends to concentrate the error field in the much less harmful octupole component. Measurements of the dipole error yield a value of the order of one milliradian for the quadrufilar magnet as compared with about six milliradians for the conventional ETA-II magnets and twelve milliradians for the ATA magnets. The improved cooling of the quadrufilar design allows DC operation at fields almost three times higher than the conventional magnets.

49267 A many particle-tracking detector with drift planes and segmentel cathode readout. Fischer, J. (Brookhaven National Lab., Upton, NY (USA)); Lissauer, D.; Ludlam, T.; Makowiecki, D.; O'Brien, E.; Radeka, V.; Rescia, S.; Rogers, L.; Smith, G.C.; Stephani, D.; Yu, B.; Greene, S.V.; Hemmick, T.K.; Mitchell, J.T.; Shivakumar, B. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 82-87 (Apr 1990). (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The authors describe the design and performance of a detector system for tracking charged particles in an environment of high track density and rates up to 1 MHz. The system operates in the forward spectrometer of the BNL heavy ion experiment E814 and uses principles of general interest in high rate, high multiplicity applications such as at RHIC or SSC. The authors require their system to perform over a large dynamic range, detecting singly charged particles as well as fully ionized relativistic ^{28}Si. Results on gas gain saturation, δ-ray suppression, and overall detector performance in the presence of a 14.6 GeV/nucleon ^{28}Si beam and a 14 GeV proton beam are presented.

49268 Initial performance of the wire imaging synchrotron radiation detector. Von Zanthier, C. (California Univ., Santa Cruz, CA (USA)); Gomez-Cadenas, J.J.; Kent, J.; King, M.; Watson, S.; Briggs, D.D.; Rouse, F.; Tinsman, J. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 44-47 (Apr 1990). DOE Contract AC03-76SF00515. (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

This paper describes the initial performance of a novel detector that measures the positions of intense synchrotron-radiation beams with high precision. Two detectors of this kind are used for the precision energy spectrometers of the Stanford Linear Collider (SLC). The detectors accurately determine the distance between pairs of intense synchrotron beams of typically 1 MeV photons, which are emitted by the primary electron and positron beams of the SLC. The detectors intercept the synchrotron beams with arrays of fine wires. The ejection of Compton-recoil electrons leaves positive charges on the wires, enabling a determination of beam positions.

49269 Neural networks for triggering. Denby, B. (Fermi National Accelerator Lab., Batavia, IL (USA)); Campbell, M.; Bedeschi, F.; Chriss, N.; Bowers, C.; Nesti, F. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 248-254 (Apr 1990). (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

This paper reports two types of neural network beauty trigger architectures, based on identification of electrons in jets and recognition of secondary vertices, simulated in the environment of the Fermilab CDF experiment. The efficiencies for B's and rejection of background obtained are encouraging.

49270 Use of fiber-optics for real-time control and data acquisition. Wong, M. (Lawrence Berkeley Lab., CA (USA)); Kirsten, F.; Haber, C.; Wester, W.; Kleinfelder, S.; Ely, R.; Merrick, T. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 336-341 (Apr 1990). DOE Contract AC03-76SF00098. (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The authors have demonstrated the practical use of commercially available fiber-optic components for high-speed control of and readout from a small prototype of an electronics data acquisition system for a high-energy physics detector. This is the SVX microvertex detector system being readied for CDF. The prototype test system set up at the Lawrence Berkeley Laboratory is described, and performance results are given. The expansion of this prototype system to the operation of a full scale microvertex physics detector front end system is also discussed.

49271 DEPOT: Database for electronics parts and other things. Logg, C.A. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)); Clancy, P.W.; Crane, G. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 347-354 (Apr 1990). DOE Contract AC03-76SF00098 ;AC03-76SF00515. (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

This paper reports on DEPOT, developed to provide tracking for the Stanford Linear Collider (SLC) control system equipment. For each piece of equipment entered in the database, a complete service, maintenance, modification, certification, location history, and, optionally, a radiation exposure history, can be maintained. To facilitate data entry accuracy, efficiency, and consistency, barcoding technology has been used extensively. DEPOT has been an important tool in improving the reliability of the microsystems controlling SLC. It is now being adopted by other systems at SLAC.

49272 The electronics and data acquisition system for the wire imaging synchrotron radiation detector at the SLC. Rouse, F. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)); Briggs, D.D.; Gomez, J.J.; Von Zanthier, C.; Kent, J. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(3): 1182-1185 (Jun 1990). DOE Contract AC03-76SF00515 ;AM03-76SF00010. (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The Stanford Large Collider (SLC) located at the Stanford Linear Accelerator Center collides electrons and positrons produced in the linear accelerator pulse by pulse. The authors determine the energy of each beam by measuring the angle of deflection of the beam in the SLC extraction lines. Each extraction line consists of two bending magnets that produce synchrotron radiation, and a spectrometer analyzing magnet that deflects the beam. The authors detect the synchrotron light by using the emission of electrons produced by Compton scattering off Cu-Be wires. The authors detect the $\sim$ 180 fC of charge on the wire by using the electronics system described in this paper. They also discuss the performance of the system, including the equivalent noise charge, crosstalk x channels, stability and reliability.

49273 Design and prototyping of the front end readout system for the CDF silicon vertex detector. Haber, C. (Lawrence Berkeley Lab., CA (USA)); Carithers, W.C.; Ely, R.P.; Holland, S.; Kristen, F.; Kleinfelder, S.; Spieler, H.; Wester, W.C.; Wong, M.;

Amidei, D.; Hrycyk, M.; Kephart, R.; Tkacek, S.; Tollestrup, A.; Yarema, R.J.; Zimmerman, T.; Bedeschi *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA)*, 37(3): 1120-1126 (Jun 1990). DOE Contract AC03-76SF00098. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

A silicon microstrip vertex detector is under construction for the Collider Detector at Fermilab (CDF). The vertex detector, which contains close to 40000 individual strips, will be read out with a full custom VLSI circuit, the SVX chip, developed for this application. This paper describes the integration of this circuit into a full front end readout system. Problems of noise, packaging, signal and power distribution, control and readout, testing, and quality control are discussed. Results are presented on the operation of a prototype system including silicon strips.

49274 A proposed scalable parallel open architecture data acquisition system for low to high rate experiments, test beams and all SSC detectors. Barsotti, E. (Fermi National Accelerator Lab., Batavia, IL (USA)); Booth, A.; Bowden, M.; Swoboda, C.; Lockyer, N.; Vanberg, R. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA)*, 37(3): 1216-1221 (Jun 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

A new era of high-energy physics research is beginning requiring accelerators with much higher luminosities and interaction rates in order to discover new elementary particles. As a consequence, both orders of magnitude higher data rates from the detector and online processing power, well beyond the capabilities of current high energy physics data acquisition systems, are required. This paper describes a proposed new data acquisition system architecture which draws heavily from the communications industry, is totally parallel (i.e., without any bottlenecks), is capable of data rates of hundreds of Gigabytes per second from the detector and into an array of online processors (i.e., processor farm), and uses an open systems architecture to guarantee compatibility with future commercially available online processor farms. The main features of the proposed Scalable Parallel Open Architecture data acquisition system are standard interface ICs to detector subsystems wherever possible, fiber optic digital data transmission from the near-detector electronics, a self-routing parallel event builder, and the use of industry-supported and high-level language programmable processors in the proposed BCD system for both triggers and online filters. A brief status report of an ongoing project at Fermilab to build a prototype of the proposed data acquisition system architecture is given in the paper. The major component of the system, a self-routing parallel event builder, is described in detail.

4304 Storage Rings

Refer also to citation(s) 49181, 49315, 49953

49275 (BNL–43928) **The Brookhaven Superconducting X-Ray Lithography Source (SXLS).** Murphy, J.B. (Brookhaven National Lab., Upton, NY (USA)); Blumberg, L.N.; Bozoki, E.; Desmond, E.; Galayda, J.; Halama, H.; Heese, R.; Hsieh, H.; Keane, J.; Kramer, S.; Mortazavi, P.; Schuchman, J.; Sharma, S.; Singh, O.; Solomon, L.; Thomas, M.; Wang, J.MBrookhaven National Lab., Upton, NY (USA). [1990]. 3p. Sponsored by U.S. Department of Defense. DOE Contract AC02-76CH00016. (CONF-900603–35: 2. European particle accelerator conference, Nice (France), 11-16 Jun 1990). Order Number DE91000120. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Synchrotron radiation from dipole magnets in electron storage rings has emerged as a useful source of x-rays for lithography. The goal of the SXLS Project at BNL is to design and construct a compact storage ring of circumference, C = 8.503 meters. It will use superconducting dipoles with a field of B_0 = 3.87 Tesla and bending radius of ρ = .6037 meters along with 700 MeV electrons to produce 10 angstrom x-rays for lithography. The project is proceeding in two phases: in Phase I low field iron dipoles are being used; in Phase II the low field dipoles will be replaced with superconducting dipoles. An overview of the design and status report are presented.

49276 (BNL–45116) **Superconducting x-ray lithography source Phase 1 (XLS) safety analysis report.** Blumberg, L. (ed.). Brookhaven National Lab., Upton, NY (USA). Jul 1990. 47p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90017628. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper discusses safety aspects associated with the superconducting x-ray lithography source. The policy, building systems safety and storage ring systems safety are specifically addressed. (LSP)

49277 (CONF-900601–9) **Realizations of polarized targets in storage rings.** Kinney, E.R. Argonne National Lab., IL (USA). [1990]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 12. international conference on particles and nuclei; Cambridge, MA (USA); 24-29 Jun 1990. Order Number DE90017800. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

While particle storage rings generally provide a large average current, they require ultra-thin targets in order to maintain a reasonable lifetime of the beam. Targets composed of polarized atomic gas are well-suited for use in storage rings because of their thinness and the high degree of purity and polarization possible. Several of these so-called internal targets have been developed and successfully used to measure scattering asymmetries at Novosibirsk; future experiments have been proposed at Bates, NIKHEF, and HERA, for example, which also rely on these techniques. The methods that have so far proved feasible for producing and storing highly polarized atoms will be reviewed. 6 refs., 1 fig.

49278 (IFVE-OEF–89-56(E-581/E-704)) **On POLEX experiment at UNK.** Nerushev, S.B. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 27p. (In Russian). Order Number DE91602363. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A wide program of polarization investigations at the UNK energies is presented. Description of polarized UNK beams is given, physical program grounding is presented. Main expected results of scientific investigations are formulated. The physical program considered includes investigations into direct photon and lepton pair productions, inclusive production of hadrons (jets) with high transmitted pulses, deep-inelastic lepton and photon scattering on polarized nucleons (measurement of spin structural functions), polarization effects in elastic particle and antiparticle scattering (including the nucleon-nuclear interference area), complete cross sections in pure spin states, as well as experiments on measuring polarization and transmission of spin in the inclusive hyperon production. 21 refs.; 18 figs.

49279 (JAERI-M–90-077) **Manufacturing of superconducting wiggler coil.** Konno, Masayuki (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Yoshida, Kiyoshi; Isono, Takaaki; Sugimoto, Makoto; Sasaki, Shigemi; Kumagai, Tateo. Japan Atomic Energy Research Inst., Tokyo (Japan). May 1990. 22p. (In Japanese). Order Number DE90520218. Source: NTIS (US Sales Only), PC A03/MF A01.

The superconducting wiggler coil system was manufactured and charged up successfully. The race track shape coil has training quench to reach rated field at its virgin running. The design and manufacturing of winding method was studied in order to reduce number of training quenches. The following manufacturing methods were studied before real coil manufacturing. (1) the resin material, (2) press during curing of winding pack, (3) accuracy of coil case. The various resin materials were evaluated concerning to adhesive strength, training of coils and easiness of winding. A small coil was manufactured and charged up in order to verify the manufacturing technique. This superconducting wiggler coil system was achieved to rated current at only after one training, and its quench current was reached the critical current of superconducting wire at the fourth charging in this experiment. (author).

49280 (RCNP-P–107, pp. 74-79) **Circulation ring and mass screening of unstable nucleus.** Itabashi, Takahisa (Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8903211–: Workshop on cyclotron cascade project, Ibaraki (Japan), 13-15 Mar 1989). In *Proceedings of the workshop on 'cyclotron cascade project'.* Order Number DE90777870. Source: NTIS (US Sales Only), PC A11/MF A01.

Greater attention has been attracted to storage and screening of unstable nuclei as nuclear physics becomes diversified. The present review, focusing on mass measurement, outlines major mass screening methods that use RF and discusses some new technologies. In principle, cyclotron resonance can be useful to screen out one q/m and remove other q/m's in its vicinity. Many mass spectrometers have been developed based on this principle including omegatoron and ion cyclotron resonance mass spectrometer. Since this type of spectrometers use a uniform magnetic field, they have the disadvantage of the absence of converging power in the vertical direction and an extremely small acceptance and transmission, indicating that they in their basic form cannot be applied to unstable nuclei. For accelerator mass spectrometry, static type accelerators such as Tandem Van de Graaff and Tandetron are used in most cases. An effort has been made at GSI to apply an energy storage ring as a TOF type mass spectrometer. Mass measurement for several particles has been carried out at Novosibirsk using a storage ring. If cooled in a storage ring, particles with a specific mass are accelerated selectively. They may be taken out of the ring by a method like resonant extraction. (N.I.).

49281 ARTEMIS: A VMS based FASTBUS module testing and evaluation system. Gorbics, M.S. (Ames Lab., IA (USA)); Crawley, H.B.; McKay, R.; Meyer, W.T.; Rosenberg, E.I.; Skeens, J.D. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 331-335 (Apr 1990). DOE Contract W-7405-ENG-82. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The authors describe a flexible FASTBUS module testing and evaluation system that has been developed in conjunction with the Ames waveform digitizer being used in the DELPHI experiment at LEP. The system hardware includes a DEC MicroVAX II (or equivalent) running micro VMS with FASTBUS and GPIB instrumentation buses. The software is menu driven, makes extensive use of the screen management routines (SMG) of the VAX/VMS system, and is designed for easy modification.

44 INSTRUMENTATION

Refer also to citation(s) 49075, 49076

49282 (LBL–26455, pp. 214-215) **Ultrahigh-vacuum apparatus for surface spectroscopy and characterization at cryogenic temperatures.** Chia, V.K.F.; Veirs, D.K.; Rosenblatt, G.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

An ultrahigh-vacuum apparatus has been designed and constructed that enables the study of molecular adsorbates on well-defined single crystals at controlled temperatures from 15 to 900 K. Sample and sample-holder cooling curves from room temperature below 15 K are shown. Sample cooling is achieved with a closed-cycle helium refrigerator coupled to the sample holder via a flexible copper cable. This configuration maintains a 3-K temperature differential from the 11-K cryocold head to the sample and damps vibrations from the cyrocold head. The cyrogenic sample manipulator allows X,Y,Z translations, tilt, and rotation of an arm holding the sample about the vertical central axis of the vacuum chamber. A detailed drawing of the sample-mounting arrangement is shown. Rotation of the sample about a working circle radius of 12.7 cm allows the sample to be accessed for surface cleaning, characterization, and study by instrumentation whose physical size does not allow access by sample rotation about the chamber central axis alone. In the authors application, unenhanced SRS, LEED, and Auger spectroscopy are carried out while maintaining a controlled sample temperature. Laser entry ports at two incident angles permit the study of substrates with differeing optical properties.

4401 Radiation Instrumentation

Refer also to citation(s) 48373, 48393, 48994, 49267, 49268, 49270, 49273, 49274, 49281, 49369, 49370, 49371, 49372, 49373, 49374, 49401, 49557, 49561, 49562, 49563, 49564, 49657, 49687, 49699, 49700, 49703, 49811, 50028, 50055, 50137, 50138, 50139, 50140, 50141, 50142, 50144, 50186, 50253

49283 (BNL–52244) **SSC detector R&D at Brookhaven National Laboratory (BNL): April 1990 Status report.** Yu, B.; Radeka, V. (eds.). Brookhaven National Lab., Upton, NY (USA). 1990. 104p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90018029. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This paper discusses the following SSC detector research: liquid argon; other calorimetry techniques; tracking; monolithic circuits; radiation effects; and simulation.

49284 (CEA-R–5523) **Proposal of a crossed Bonse-Hart type camera at E.S.R.F. for very high resolution X-Ray diffraction and very low angle scattering.** Zemb, T. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Inst. de Recherche Technologique et de Developpement Industriel); Lambard, J.; Lesieur, P.; Bernon, R.; Roux, D.; Barois, P.; Williams, C. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI). 1990. 38p. (In French). Order Number DE91702163. Source: NTIS (US Sales Only), PC A03/MF A01.

We propose a crossed Bonse-Hart diffractometer, unique in it's conception, optimised for the measurement of scattered intensity very near from the direct beam and for the study of the lineshape from crystals, colloidal crystals and liquid crystals. The resolution and the dynamic of a high resolution apparatus are conventionnaly defined as the ratio R between the incident flux at $2\theta=0$ and the remaining flux at $2\theta=30$ min of arc. None of the apparatus programmed at the European Synchrotron Radiation Facility (ESRF) is optimised in order to get the maximum ratio R. We propose a camera which might allow to obtain the best rejection ratio of parasitic light in the world. The 4 circles diffractometer carrying the sample is placed after a monochromator composed of several channel cut crystals. The assembly of crossed crystals ensures the parallelism of the incident beam along the horizontal and vertical directions. The analysis is performed by a 5 reflections channel cut crystal associated with a CCD linear multidetector. The sensitivity of this apparatus for samples of low contrast or diluted samples is not reached onto any existing X-ray camera: a ratio larger than 10^9 is waited between the direct beam intensity and that of the parasitic light for a q value of 0.001 A^{-1}. This crossed Bonse-Hart diffractometer will allow measurements for momentum transfers as low as q=0.0001 A^{-1}.

49285 (CONF-901121–4) **Parallelization of a radiation transport simulation code on the BBN TC2000™ parallel computer.** Celmaster, W. (BBN Advanced Computers, Inc., Cambridge, MA (USA)); May, E.N. Argonne National Lab., IL (USA). [1990]. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Association for Computing Machinery/Institute of Electrical and Electronics Engineers supercomputing conference; New York, NY (USA); 12-16 Nov 1990. Order Number DE90013662. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We describe the parallelization of a radiation transport Monte Carlo simulation code that was used in the design of a particle detector.

49286 (CONF-9003159–2) **Can a Pb/SCIFI calorimeter survive the SSC?.** Hertzog, D.W. (Illinois Univ., Urbana, IL (USA)); Hughes, S.A.; Reimer, P.E.; Taylor, R.L.; Johnson, K.F.; Majewski, S.; Zorn, C.; Zorn, M. Illinois Univ., Urbana, IL (USA). [1990]. 12p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract FG05-87ER40319. Contract PHY 89 21146.

From Workshop on radiation hardness of plastic scintillator; Tallahassee, FL (USA); 19-21 Mar 1990. Order Number DE90017448. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A scintillating fiber based electromagnetic calorimeter module built from radiation-hard materials has been tested in a beam capable of delivering both low and high currents of monoenergetic electrons. Energy resolution and light output measurements were made following high-dose exposures. The procedure was repeated until the resolution of the detector decreased from an initial value of 6.9%$\sqrt{E}$ to 14.0%$\sqrt{E}$ and the pulse height dropped by a factor of 11. After four weeks, the detector was retested. Partial recovery was observed in the light output which returned to approximately 52% of its original value. The resolution recovered to a value of 8.8%$\sqrt{E}$. The tests are described. 9 refs., 4 figs.

49287 (CRN-HE–8906) **Experimental study of the single electron response of the DELPHI Barrel RICH MWPC's.** Dracos, M. (Strasbourg-1 Univ., 67 (FR). Centre de Recherches Nucleaires); Loukas, D. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. 1989. 30p. Order Number DE91702151. Source: NTIS (US Sales Only), PC A03/MF A01.

We present herewith the results of an experimental study of the multiwire proportionnal chambers (MWPC's) used in the Barrel RICH particle identifier of the LEP-DELPHI experiment. Emphasis is given to the problem of detection efficiency and to the measurements of the charge induced by a single photoelectron.

49288 (EFI–995(45)-87) **Technique for investigation of hadron groups in ionization calorimeter.** Avakyan, V.V.; Karagezyan, G.V.; Ovsepyan, G.G.; Ter-Antonyan, S.V. Erevanskij Fizicheskij Inst., Erevan (USSR). 1987. 28p. (In Russian). Order Number DE91602549. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

An effective technique for separation of hadron groups families in ionization calorimeters is developed and introduced. The suggested method allows one to adapt operatively the computer program to the design peculiarities of concrete setups of calorimetric type. In case of an iron absorber a double-parametric approximation of mean cascade curves is proposed to estimate the energy of the group components. The relative accuracy of estimations at energy $E \geq 500$ GeV does not depend on the energy of hadrons. 11 refs.; 3 figs.

49289 (EFI–1000(50)-87) **Low-pressure chamber for registration of fission fragments of heavy nuclei.** Arakelyan, E.A. (and others); Bayatyan, G.L.; Grigoryan, N.K. Erevanskij Fizicheskij Inst., Erevan (USSR). 1987. 10p. Order Number DE91602565. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

A low-pressure chamber is described and its characteristics are tested in laboratory conditions as well as using photon and electron beams. The chanber is intended for registration of the fission fragments of heavy nuclei. Preliminary measurements of the photofission yield cross section of uranium for the maximal photon energy of 4.5 GeV and uranium electrofission cross section for the electron energy of 1 GeV are presented. 3 refs.; 6 figs.

49290 (EFI–1017(67)-87) **Optimal transition X radiation detectors for particle identification in a wide energy range.** Kazaryan, S.P.; Movsesyan, S.N.; Shikhlyarov, K.K. Erevanskij Fizicheskij Inst., Erevan (USSR). 1987. 25p. (In Russian). Order Number DE91602548. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The optimal parameters for transition X radiation detectors based on the cluster-counting method for secondary particle identification are calculated. The capabilities of such detectors in pion/kaon, kaon/proton, pion/proton separation in the energy range $\approx$ 100-1500 GeV and that for electron/pion one within the energy range $\approx$ 3-200 GeV are analyzed. 6 refs.; 19 figs.

49291 (EFI–1022(72)-87) **32-input gating circuit for event selection.** Balayan, Z.K.; Vartanyan, G.S.; Kechyan, K.P.; Papyan, A.K. Erevanskij Fizicheskij Inst., Erevan (USSR). 1987. 8p. (In Russian). Order Number DE91602566. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

A event selecting circuit fixing in the binary code an arbitrary number of coincidences of 32 input signals with the gating pulse is described. The width of input signals is $\geq$ 15 ns. 5 refs.; 3 figs.

49292 (EFI–1045(8)-88) **Identification of cosmic heavy nuclei in an assembly of nuclear photoemulsions and dielectric track detectors.** Akopova, A.B. (and others); Arutyunyan, M.M.; Gertsen, G.N. Erevanskij Fizicheskij Inst., Erevan (USSR). 1988. 19p. (In Russian). Order Number DE91602567. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

In a multilayer assembly comprised of a sandwich of dielectric track detectors (DTD) and nuclear photoemulsions (NPE) exposed on the board of the Cosmos-1672 satellite as a part of the Quartz scientific apparatus, the tracks of nuclei from the iron group ($22 \leq Z \leq 28$) have been identified. The tracks of iron nuclei detected in DTD are used to find the continuation of these tracks in NPE layers controllable by the registration threshold and processed by the method of selective development. On the example of a detected particle with $Z=70 \pm 5$ the effectiveness of combination of two types of detectors in search for cosmic heavy nuclei is shown. 18 refs.; 7 figs.

49293 (FSU-HEP–041090) **CAD tools for detector design.** Womersley, J. (Florida State Univ., Tallahassee, FL (USA). Dept. of Physics); DiGiacomo, N.; Killian, K. Florida State Univ., Tallahassee, FL (USA). Dept. of Physics. Apr 1990. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-87ER40319. (CONF-9003202–1: International industrial symposium on the supercollider, Miami Beach, FL (USA), 14-16 Mar 1990). Order Number DE90017337. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Detailed detector design has traditionally been divided between engineering optimization for structural integrity and subsequent physicist evaluation. The availability of CAD systems for engineering design enables the tasks to be integrated by providing tools for particle simulation within the CAD system. We believe this will speed up detector design and avoid problems due to the late discovery of shortcomings in the detector. This could occur because of the slowness of traditional verification techniques (such as detailed simulation with GEANT). One such new particle simulation tool is described. It is being used with the I-DEAS CAD package for SSC detector design at Martin-Marietta Astronautics and is to be released through the SSC Laboratory.

49294 (IAE–4741-4) **Study on the effect of main performance of Si-surface-barrier detectors of different area on the noise and timing parameters of a charged particle spectrometer.** Mazurov, I.B.; Dukhanov, V.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1988. 8p. (In Russian). Order Number DE91602537. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Effect of main performances of Si-surface-barrier detectors on energy and time resolution of charged particle spectrometers is studied. For this purpose volt-ampere characteristics of 4.6cm^2, 20.3cm^2, 3cm^2 detectors were measured and capacitances of P-N-junctions of detectors depending on applied voltage were determined. Effect of noises and capacitances detectors on fluctuations of time coupling to detector pulses was estimated. Measurements and calculations showed that 4.6cm^2 and 3.0cm^2 area detectors may be used for time-of-flight methods beginning from 5 MeV threshold and provide for 0.4-0.5 ns time coupling accuracy. 3 refs.; 5 figs.; 3 tabs.

49295 (IAE–4849-14) **Study on the main performance of charged particle multichannel spectrometers at high input counting rates.** Mazurov, I.B.; Sibiryak, Yu.G. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 12p. (In Russian). Order Number DE91602538. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The article describes the basic dynamic characteristics of the amplification channel being a part of multichannel spectrometer of charged particles at high counting rates. The values of the peak-shift and the resolution change depending on input counting rates have been measured. The deadtime of the pile-up rejection have

been determined. The spectra have been obtained in the region of double superimpositions formed at various time constants in the fast filtering amplifier. The impulse rejection efficiency for the random generator and semiconductor detector has been estimated. The counting rate characteristics of the amplification channel and the calculation of the dead-time losses with pile-up rejection have been presented.

49296 (IFVE-OEF–89-99) **Minidrift chambers. Operation with different gas mixtures.** Derevshchikov, A.A. (and others); Erin, S.V.; Morozov, A.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 14p. (In Russian). Order Number DE91602553. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The influence of different gas mixtures, primary ionization, cathode materials and geometrical parameters of a drift cell on the minidrift chamber operation has been studied. It has been found, that a jump in charge characteristics during transition to self-quenching (SQ) mode is observed for a single electron when working with CO_2+$CH_2(OCH_3)_2$ mixture, while under Fe^{55} ionization no jump is observed. 19 refs.; 14 figs.

49297 (IFVE-OEF–89-103) **Application of the high-current wire photodetector for Cherenkov radiation ring detecting: Recent progress and future development.** Buzulutskov, A.F.; Vasil'chenko, V.G.; Turchanovich, L.K. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 15p. (In Russian). Order Number DE91602550. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The Cherenkov radiation detector based on a high-current chamber (HCC) designed for particle separation in the energy range of 0.5-500 GeV is described. The Cherenkov counter consists of three main elements: a gas radiator of a spherical mirror and a drift chamber. Variants of HCC construction with electric readout of information and optical method of information readout based on CCD-matrix are considered. Variants of the Cherenkov radiation detectors based on HCC for low (0.8-4 GeV), average (20-80GeV) and high (upto 500 GeV) energies are discussed. HCC with optical readout of information has gas amplification 10^{10}, coordination solution 1 mm, loading with background events 10^{7}/s, and if provides uniqueness of photon registration with multiplicity higher than 10^{4}. 13 refs.; 12 figs.; 1 tab.

49298 (IFVE-OEF–89-105) **Specialized processor for particle momentum selection in the experiment to study of central hadron collisions.** Donskov, S.V. (and others); Inyakin, A.V.; Mikhajlov, Yu.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 12p. (In Russian). Order Number DE91602551. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A specialized processor used for particle selection by their momenta in the experiment studying the central hadron collisions at the IHEP 70 GeV accelerator is described. The processor consists of the registers and decision modules. Particle coordinates and their number in the scintillation hodoscope plane are measured with the registers. Information is transfered to the decision module, where in accordance with the particle deflection in magnetic field its momentum is determined. The momentum value is compared with the preset one and the second-level trigger signal is produced. The processor has been effectively used to distinguish events of central hadron collisions. 11 refs.; 6 figs.; 1 tab.

49299 (IFVE-OEF–89-131) **Fast-cycling minidrift chamber with freon-14 (80%) and isobutan (20%) mixture.** Kurchaninov, L.L.; Myalitsyn, V.K.; Sushkov, V.V.; Shuvalov, R.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 6p. (In Russian). Order Number DE91602552. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The design of a 10x10 chamber and its electronics are described. The chamber operates with intensity of $1.3x10^{6}$ particle/s per wire and 100% efficiency. The noise between adjacent wires is 3%. 5 refs.; 4 figs.

49300 (IFVE-ONF–89-135) **Spatial resolution of electromagnetic liquid krypton calorimeter: Monte-Carlo simulation.** Krasnokutskij, R.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij); Kurchaninov, L.L.; Rykov, V.L.; Fedyakin, N.N.; Shuvalov, R.S.; Tikhonov, V.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 21p. (In Russian). Order Number DE91602554. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Submitted to NIM.

The influence of induction effect and multiple Coulomb scattering on spatial resolution of electromagnetic liquid krypton calorimeter, when determining gamma-quanta coordinate by the charge division in the capacitance line, is studied. Monte Carlo calculation confirmed the assumption, that for l=10mm strip width detector the induction effect must not influence significantly the finite results. With corresponding values of coupling constant and strip width the detector spatial resolution is defined as $\approx l/\sqrt{12}$ mm. When determining gamma-quantum coordinate by charge division in the capacitance line for E=0.1-1GeV the strip decrease to less than 3mm is meaningless due to contribution of multiple Coulomb scattering, which defines spatial resolution limit as $\approx$ 0.6-0.7 mm. 11 refs.; 5 figs.; 2 tabs.

49301 (IFVE-ORI–89-123) **On interpreting the results of personnel dosimeter intercomparison.** Golovachik, V.T.; Lebedev, V.N.; Sannikov, A.V.; Spirov, E.G. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 13p. (In Russian). Order Number DE91602533. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The method of interpretating the readings of the thermoluminescent detectors (TLD), those were used in the International intercomparison of individual photon dosimeters (IAEA, 1988), is described. A possibility of measuring the new ICRU dosimetric quantities $H_s(0.07)$ and $H_i(10)$ was checked in the intercomparison alongside with the maximum dose equivalent estimation. Measurement accuracy is analyzed. It is shown that the simple TLD dosimetry system allows to measure the new dosimetric quantities with an accuracy about 10% in the energy range from 18 to 1250 keV. 7 refs.; 4 figs.; 5 tabs.

49302 (IPPCZ–293/III, pp. 108-119) **Neutron spectrometers for the T-15 tokamak.** Volski, J. (Instytut Fizyki Plazmy i Laserowej Mikrosyntezy, Warsaw (Poland)); Vyzgal, J. Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. (In Russian). (CONF-890322–: 3. conference on solid-liquid separation practice, Bradford (UK), 29-31 Mar 1989). In *Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak"*. Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

A neutron spectrometer with a liquid scintillator detector was developed for measurements of neutrons with an energy around 2.5 MeV in the T-15 tokamak. The preliminary calibration tests of the detector made using a neutron source of the Van de Graaff type and radionuclide sources of gamma radiation confirmed the proper function of the spectrometer. The results of calculations of the collimator shielding efficiency suggest the necessity of increasing the shielding. Finally, the design of a neutron spectrometer for the energy range of 14 MeV is discussed. (J.U.).

49303 (ITEF–58-89) **Possibility of experiments using radiation counters for test electron stability and Pauli principle violation in atoms.** Barabash, A.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1989. 12p. (In Russian). Order Number DE91602539. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Capabilities of modern radiation detectors for investigation into electron stability and possible violation of Pauli principle in atoms are discussed. For experimental searches of electron instability the following low-background devices are used: scintillation NaI-detectors, semiconducting detectors of enriched germanium, emission chamber, multisection proportional counter and

low-temperature detectors. It is ascertained that using modern low-background devices applying the earlier enumerated detectors, it is possible to achieve sensitivity of the order of 10^{24}-10^{25} years for the electron lifetime relatively to its decay and Pauli principle violation in atoms. Experiments with sensitivity of $\approx 10^{26}$-10^{27} can be realized in massive low-temperature detectors, developed for neutrino physics. 28 refs; 1 fig.

49304 (ITEF–77-89) **Photoemulsion vertex detector at the SKIF installation.** Egorov, O.K.; Lebedev, A.I.; Pasko, S.I.; Smirnitskij, V.A.; Stepanov, A.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1989. 16p. (In Russian). Order Number DE91602555. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A photoemulsion vertex detector of a hybride spectrometer with streamer and spark chambers to study the processes of charmed baryons generation and decay, is described. 8 refs.; 6 figs.

49305 (JINR–13-89-164) **Data acquisition system in CAMAC standard for multiparameter experiments.** Bogdzel', A.A. (and others); Ermakov, V.A.; Semenov, Yu.B. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics. 1989. 8p. (In Russian). Order Number DE91602541. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Submitted to Organizing Committee of the Intern. Seminar CAMAC-89, Peking, China, June 27-29 1989.

The system for measuring simultaneously main characteristics of reaction products and their mutual correlations is described. 8(ADC) analog-to-digital converters and a specialized controller are used for entering information. By means of the controller ADC data enters the data bus and the buffer memories wich acts in flip-flop mode and the analizator memories where 8 one-dimensional ADC spectra are stored. By means of a track ball two-dimensional spectra regions are transferred in digital filtration modules (DFM) by a computer. The DFM makes preliminary selection of events in written regions. Simultaneously the DFM sorts data over codes of the selected regions to one-dimensional spectra which are stored in the analyzer memory modules. Its software is designed for the SM-3 type computer. 1 ref.; 1 fig.

49306 (JINR-R–1-89-87) **About a possibility to study the diffraction dissociation on the vertex detector spectrometer.** Gramenitskij, I.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy); Takhtamyshev, G.G.; Devenski, P.A. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. 1989. 17p. (In Russian). Order Number DE91602557. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A new cluster method for separating the diffractions dissociation processes is described. The matrix of angles between momenta of secondary particles in the centre-of-mass system is used in this method. The so-called minimal spanning tree (MST) is being built which are a minimal distance between geodesics on a unit sphere connecting the secondary particles. Separation into clusters goes via breaking the longest distance in MST. To investigate a possibility of applying the method for the magnetic spectrometer with vertex detector the diffraction dissociation events generated by the Monte Carlo method transmit the set up. The average efficiency of separating the single dissociation processes turned out to be more than 90%. This evidences in favour of a possibility to apply the method in experiments on the magnetic spectrometer with vertex detector. 6 refs.; 4 figs.; 1 tab.

49307 (JINR-R–1-89-206) **Processing of the information from gamma detector at SIGMA-AJAX setup.** Gorin, Yu.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij); Kartasheva, V.G.; Petrukhin, A.I.; Gornushkin, Yu.A.; Leitner, R.; Ol'shevskij, A.G. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 14p. (In Russian). Order Number DE91602556. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The processing of experimental information about registration of photons by the lead glass Cherenkov counters with the transverse size 10x10cm^2 is explained. The determination of coordinate and energy of photons measured by such counters is described as well as the method of separation of events worth photons and hard π^0 in final state. The procedure of combining with help of γ-detector of two different data samples of radiative π^-p-scattering are given. All described methods allowed the successfull study of processes of $\pi\pi^0$-production by pions in the nuclear Coulomb field and radiative π^-p-scattering at SIGMA-AJAX setup. 3 refs.; 9 figs.; 1 tab.

49308 (JINR-R–13-89-115) **Gas laser spectrometer for nuclear investigation at nucleonic stability limit. (project).** Myshinskij, G.V. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions. 1989. 8p. (In Russian). Order Number DE91602540. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

It is proposed to obtain the atomic beam of the proton-rich and neutron-rich nuclides with half-lives of up to 1 ms, by using the gas-jet technique. Subsequently their properties are investigated using the methods of laser resonance ionization and nuclear spectroscopy. 8 refs.; 4 figs.

49309 (KEK–89-17, pp. 111-119) **Charm physics in B factory.** Enomoto, Ryoji (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Nov 1989. (In Japanese). (CONF-8910393–: Workshop for asymmetric B-factory at KEK, Tsukuba (Japan), 2-4 Oct 1989). In *Proceedings of the workshop on asymmetric B factory at KEK.* Order Number DE90777869. Source: NTIS (US Sales Only), PC A12/MF A01.

The accelerator and detector used in the B factory at KEK has been optimized for the measurement of CP violation, b→ transition and B_s mixing. The B factory, however, has been shown to be very useful also for other purposes. The B factory has the features that it incorporates an asymmetric collision type accelerator having a high beam intensity with a luminosity of 10^{33}, that the system can measure the vertex with a high resolution of 50 μm, that it can identify almost any particle, and that it can detect gamma rays above 50MeV. The report discusses these features focusing on charm physics. Most experiments at the B factory are performed at energies corresponding to the Y (4s, 5s) resonant state. At a luminosity of 10^{33}, several charm mesons are produced in a second, indicating that as many as more than 10^7 charms can be produced in a year (assumed to be equivalent to 100 days). Charm physics that can be studied at the B factory are discussed focusing on spectroscopy, decay modes, D mixing and CP violation. These considerations indicate that the B factory is very helpful for research in charm physics without any significant modification to the system. (N.K.).

49310 (KEK–89-17, pp. 142-159) **Electromagnetic shower calorimeter.** Tamai, Kunio (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Nov 1989. (In Japanese). (CONF-8910393–: Workshop for asymmetric B-factory at KEK, Tsukuba (Japan), 2-4 Oct 1989). In *Proceedings of the workshop on asymmetric B factory at KEK.* Order Number DE90777869. Source: NTIS (US Sales Only), PC A12/MF A01.

There are several types of electromagnetic shower calorimeters that may use an inorganic crystal scintillator made of NaI, CsI, BaF_2 or BGO, may consist of alternating layers of lead and plastic scintillators (referred to as Pb-Sc), or may use Cerenkov radiation generated in lead glass. In e^+e^- experiments, they play an important role for event trigger, $e^\pm/\Pi^\pm$ separation and gamma ray energy measurement. The present report compares the performance of the CsI detector and that of the Pb-Sc detector. The features of these detectors are briefly discussed in relation to $e^\pm/\Pi^\pm$ separation. Simulation is carried out for a measuring system proposed for an asymmetric B factory. Results are discusses in relation to the quality and accuracy of measurements made by the CsI detector and Pb-Sc detector. When used to provide trigger pulse, the CsI is inferior in that the damping time of scintillation pulse is long, though it can match the Pb-Sc detector with respect to the time resolution. The CsI is superior for $e^\pm/\Pi^\pm$ separation. Strong background occurs when a Pb-Sc detector is applied to the $Bd\rightarrow\Psi K_s$ decay. This should be taken into account when it is use examine the CP violation. (N.K.).

49311 (KEK–89-17, pp. 160-166) **Particle identification in B-physics.** Enomoto, Ryoji (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Nov 1989. (In Japanese). (CONF-8910393–: Workshop for asymmetric B-factory at KEK, Tsukuba (Japan), 2-4 Oct 1989). In *Proceedings of the workshop on asymmetric B factory at KEK.* Order Number DE90777869. Source: NTIS (US Sales Only), PC A12/MF A01.

Identification of charged K mesons is essential in CP violation experiments. It may be achieved based on energy loss and time of flight or by using a ring image Cerenkov detector (RICH). The former approach suffers from noise due to charged π mesons. Compared to this, the latter approach can identify K mesons with high accuracy though further improved techniques still have to be developed. RICH is based on novel technologies currently under development. When charged particles of a high speed pass through a medium with a certain refractive index, they emit Cerenkov radiation in a direction that depends on their speed. The radiation emitted from a medium with a large refractive index form a circle when observed at a certain distance from the medium. The speed of the particles can be determined from an accurate measurement of the radius of the circle. The major feature of RICH is that it can identify particles in a very wide momentum range. Some simple and positive mechanisms for RICH have been proposed recently. For instance, the use of NaF crystal and triethylamine gas MWPC as radiator and photon detector, respectively, permits the elimination of loss in light, operation at normal temperature and a decrease in thickness. (N.K.).

49312 (KEK–89-17, pp. 167-182) **Tracking.** Nozaki, Tadao (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Nov 1989. (In Japanese). (CONF-8910393–: Workshop for asymmetric B-factory at KEK, Tsukuba (Japan), 2-4 Oct 1989). In *Proceedings of the workshop on asymmetric B factory at KEK.* Order Number DE90777869. Source: NTIS (US Sales Only), PC A12/MF A01.

The report discusses the design requirements for a tracking system to be incorporated in an asymmetric B meson collision type accelerator which uses two beams with different energies. Features of BB-bar events that would occur in the asymmetric B factory are described first. Accuracy of the measurement of the momentum made in a drift chamber is then discussed. An equation for the accuracy is derived, and the error in measuring the momentum due to multiple scattering and the angular dependence of the accuracy of momentum measurement are argued. Discussion is also made of the requirements for angular and momentum measurement, focusing on the required range of angular and momentum measurement. The measuring accuracy of the microvertex measuring system is examined. Major requirements for a tracking system to be used for experiments in the asymmetric B factory are as follows. The intensity of the magnetic field should be in the range of 10-15KG. Angular measurement should be made over the range of $-0.71<\cos\theta<0.95$ at least. It should be up to 0.98 if possible. The gas to be used in the drift chamber should be light gas such as He/DME. The microvertex measuring system should consist of a thin, small-diameter beam pipe and a thin silicone strip. (N.K.).

49313 (KEK–89-17, pp. 183-191) μ **particle detector.** Sagawa, Hiroyuki (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Nov 1989. (In Japanese). (CONF-8910393–: Workshop for asymmetric B-factory at KEK, Tsukuba (Japan), 2-4 Oct 1989). In *Proceedings of the workshop on asymmetric B factory at KEK.* Order Number DE90777869. Source: NTIS (US Sales Only), PC A12/MF A01.

A B meson can be identified as either B^0 or $\bar{B}^0$ by examining the leptons generated from the first decay process of the B meson. The study focuses on the μ particle as one of such leptons. If the parent B meson comprises a b quark, its decay will generate a μ^- particle. If the parent B meson comprises an anti-b quark, its decay will generate a μ^+ particle. Whether the parent B meson is B^0 (B^-) or $\bar{B}^0$ (B^+) can be determined by examining whether the resultant μ particle has a positive or negative charge. Identification of the μ particle from other particles is carried out based on the fact that the μ particle does not participate in strong interaction. In a typical experiment, a thick steel plate is placed near the charged particle's momentum detector or the electromagnetic calorimeter. Most charged particles other than μ cannot pass through the steel plate due to their strong interaction with the steel while the μ particle is allowed to come out of the plate. There will be a background due to a small number of other charged particles that can pass through the plate and other μ particles that are formed from the decay of charged K or π mesons. Such background can be reduced by using the fact that the μ particle formed directly from the B meson has a large momentum. (N.K.).

49314 (KEK–89-26, pp. 100-114) **Development of second level trigger system based on a microprocessor array in the TRISTAN VENUS experiment.** Sakamoto, Hiroshi (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1990. (CONF-8903226–: Symposium on data acquisition and processing for next generation experiments, Tsukuba (Japan), 9-10 Mar 1989). In *Proceedings of symposium on data acquisition and processing for next generation experiments.* Order Number DE90508151. Source: NTIS (US Sales Only), PC A11/MF A01.

A second level trigger system is being developed at VENUS. The system consists of a lot of microprocessors which are connected together and form an array. In the system, hit information of the central drift chamber is processed in parallel and reconstruction of tracks is performed. Present status of the development, especially on the evaluation of the hardware performance and on the outline of the software, is reported. (author).

49315 (KEK–89-26, pp. 115-124) **Upgrade of the AMY trigger system.** Lusin, S. (South Carolina Univ., Columbia, SC (USA)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1990. (CONF-8903226–: Symposium on data acquisition and processing for next generation experiments, Tsukuba (Japan), 9-10 Mar 1989). In *Proceedings of symposium on data acquisition and processing for next generation experiments.* Order Number DE90508151. Source: NTIS (US Sales Only), PC A11/MF A01.

A proposed upgrade of the trigger system for the AMY detector at the TRISTAN e^+e^- collider is described. The upgrade involves making use of azimuthal information from the central drift chamber to identify radial tracks traversing the chamber. (author).

49316 (ORNL/FTR–3730) **[An experiment at GSI/SIS to study the 4π detector system]: Foreign trip report, June 9–September 5, 1990.** Shapira, D. Oak Ridge National Lab., TN (USA). 20 Sep 1990. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90017843. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler was invited by the Second Physics Institute at the University of Giessen and the KP2 group at the GSI/SIS facility to participate in the first runs of the TAPS (Two-Arm Photon Spectrometer), and the 4π detector array at the newly commissioned SIS facility. There has been ongoing collaboration between the group of the Second Physics Institute at Giessen, headed by Prof. Metag, and the collision dynamics group at HHIRF. One of their graduate students (D. Rentsch) is currently working on his Ph.D. thesis which is based on data taken at HHIRF during the summer of 1988 with the HILI detector. The traveler has held numerous discussions clarifying some outstanding problems and helping with the analysis of these HILI data.

49317 (RCNP-P–107, pp. 129-146) **Plan for focal plane polarimeter for Grand Raiden.** Sakaguchi, Harutaka (Kyoto Univ. (Japan). Faculty of Science); Hirata, Shoichi; Sotogawa, Hiroaki. Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8903211–: Workshop on cyclotron cascade project, Ibaraki (Japan), 13-15 Mar 1989). In *Proceedings of the workshop on 'cyclotron cascade project'.* Order Number DE90777870. Source: NTIS (US Sales Only), PC A11/MF A01.

Grand Raiden, a large-size spectrograph with world's highest performance, is currently being produced to be used with a large-scale cyclotron with a proton acceleration energy of 400 MeV under construction at RCNP. The focal plane polarimeter (FPP) is intended to measure the polarization degree of the spin of particles

coming into the focal plane of the spectrograph. It comprises a dipole for spin rotation (DSR), focal plane position detector and polarimeter. DSR causes particles to spin in a direction that permits easy measurement by the polarimeter. The present report describes the background against the development of the FPP, significance of the observable of spin, effectiveness of the combination of the Grand Raiden with a FPP, different focal plane polarimeters used in the world, and physical studies expected to be carried out in the future using a focal plane polarimeter. For the FPP for Grand Raiden, the report describes the features of the FPP, structure of the FPP for Grand Raiden, structure of the trigger system, required performance of the FPP, and estimation of the cost required for the production of the FPP (calculated at approximately 100 million yen). (N.K.).

49318 (UCRL-JC-103762) **Multiple-energy techniques in industrial computerized tomography.** Schneberk, D.; Martz, H.; Azevedo, S. Lawrence Livermore National Lab., CA (USA). 1 Aug 1990. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-900791-2: Review of progress in quantitative NDE, La Jolla, CA (USA), 15-20 Jul 1990). Order Number DE90017518. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Considerable effort is being applied to develop multiple-energy industrial CT techniques for materials characterization. Multiple-energy CT can provide reliable estimates of effective Z (Z_{eff}), weight fraction, and rigorous calculations of absolute density, all at the spatial resolution of the scanner. Currently, a wide variety of techniques exist for CT scanners, but each has certain problems and limitations. Ultimately, the best multi-energy CT technique would combine the qualities of accuracy, reliability, and wide range of application, and would require the smallest number of additional measurements. We have developed techniques for calculating material properties of industrial objects that differ somewhat from currently used methods. In this paper, we present our methods for calculating Z_{eff}, weight fraction, and density. We begin with the simplest case – methods for multiple-energy CT using isotopic sources – and proceed to multiple-energy work with x-ray machine sources. The methods discussed here are illustrated on CT scans of PBX-9502 high explosives, a lexan-aluminum phantom, and a cylinder of glass beads used in a preliminary study to determine if CT can resolve three phases: air, water, and a high-Z oil. In the CT project at LLNL, we have constructed several CT scanners of varying scanning geometries using γ- and x-ray sources. In our research, we employed two of these scanners: pencil-beam CAT for CT data using isotopic sources and video-CAT equipped with an IRT micro-focal x-ray machine source.

49319 Quasiparticle mixers and detectors. Hu, Q. (Lawrence Berkeley Lab., CA (USA). Materials and Chemical Sciences Div.); Richards, P.L. pp. 169-196 of Superconducting devices. Ruggiero, S.T.; Rudman, D.A. Academic Press Inc., San Diego, CA (USA) (1990). DOE Contract AC03-76SF00098.

This paper discusses the phenomena of superconducting tunneling. Focus is on the superconductor-insulator-superconductor (SIS) mixer. Properties and figures of merit for infrared and millimeter wave devices are presented.

49320 A fast large-area position-sensitive time-of-flight neutron detection system. Crawford, R.K. (Argonne National Lab., IL (USA)); Haumann, J.R. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 72-81 (Apr 1990). DOE Contract W-31-109-ENG-38. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

This paper reports on a new position-sensitive time-of-flight neutron detection and histograming system developed for use at the Intense Pulsed Neutron Source. Spatial resolution of roughly 1 cm x 1 cm and time-of-flight resolution of $\sim$ 1 μsec are combined in a detection system which can ultimately be expanded to cover several square meters of active detector area. This system is based on the use of arrays of cylindrical one-dimensional position-sensitive proportional counters, and is capable of collecting the x-y-t data and sorting them into histograms at time-averaged data rates up to $\sim$ 300,000 events/sec over the full detector area and with instantaneous data rates up to more than fifty times that. Numerous hardware features have been incorporated to facilitate initial tuning of the position encoding, absolute calibration of the encoded positions, and automatic testing for drifts.

49321 Lead carbonate: A new fast, heavy scintillator. Moses, W.W. (Research Medicine and Radiation Biology Div. Lawrence Berkely Lab., Berkeley, CA (US)); Derenzo, S.E. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 96-100 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The authors describe the scintillation properties of lead carbonate ($PbCO_3$), a newly discovered, heavy (6.6 g/cm^3), inorganic scintillator. its fluorescence decay lifetime, measured with the delayed coincidence method, is described by a sum of three exponentials; 24% of the light is emitted with a 5.6 $\pm$ 1 ns time constant, 48% of the light is emitted with a 27 $\pm$ ns time constant, and 28% is emitted with a 155 $\pm$ 10 ns time constant. The emission spectrum peak is centered at a wavelength of 475 nm, and drops to less than 10% of its peak value at 370 nm and 580 nm.

49322 Design of a wire imaging synchrotron radiation detector. Kent, J. (California Univ., Santa Cruz, CA (USA)); Gomez-Cadenas, J.J.; Hogan, A.; King, M.; Rowe, W.; Watson, S.; Von Zanthier, C.; Briggs, D.D.; Levi, M. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 48-52 (Apr 1990). DOE Contract AC03-76SF00098. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

This paper documents the design of a detector invented to measure the positions of synchrotron radiation beams for the precision energy spectrometers of the Stanford Linear Collider (SLC). The energy measurements involve the determination, on a pulse-by-pulse basis, of the separation of pairs of intense beams of synchrotron photons in the MeV energy range. The detector intercepts the beams with arrays of fine wires. The ejection of Compton recoil electrons results in charges being developed in the wires, thus enabling a determination of beam positions.

49323 A study of wire chambers with highly segmented cathode pad readout for high multiplicity charged particle detection. Debbe, R. (Yale Univ., New Haven, CT (USA)); Fischer, J.; Lissauer, D.; Ludlam, T.; Makowiecki, D.; O'Brien, E.; Radeka, V.; Rescia, S.; Rogers, L.; Smith, G.C.; Stephani, D.; Yu, B.; Greene, S.V.; Hemmick, T.K.; Mitchell, J.T.; Shivakumar, B. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 88-94 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

Investigations of interpolating cathode pad readout have been carried out for high multiplicity, two dimensional position sensitive detection of minimum ionizing particles and heavy ions. A detector configuration representing only 0.6% of a radiation length and covering an area of 26 cm by 16 cm, with over 1000 readout channels, has been developed. In a prototype chamber using this technique, a resolution of less than 100 μm (rms), for 5.4 keV x-ray, and differential non-linearity of $\pm$ 6% have been achieved. The technique has also been demonstrated for detectors of much larger area.

49324 Improved charge collection of the buried p-i-n- a-Si:H radiation. Fujieda, I. (Lawrence Berkeley Lab., CA (USA)); Cho, G.; Conti, M.; Drewery, J.; Kaplan, S.N.; Perez-Mendez, V.; Qureshi, S.; Street, R.A. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 124-128 (Apr 1990). DOE Contract AC03-76SF00098. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

Charge collection in hydrogenated amorphous silicon (a-Si:H) radiation detectors is improved for high LET particle detection by adding thin intrinsic layers to the usual p-i-n structure. This buried p-i-n structure enables us to apply higher bias and the electric field is enhanced. When irradiated by 5.8 MeV α particles, the 5.7 μm

thick buried p-i-n detector with bias 300 V gives a signal size of 60,000 electrons, compared to about 20,000 electrons with the simple p-i-n detectors. The improved charge collection in the new structure is discussed. The capability of tailoring the field profile by doping a-Si:H opens a way to some interesting device structures.

49325 The HgI_2 energy dispersive x-ray array detectors and miniaturized processing electronics project. Iwanczyk, J.S. (University of Southern California, Marina Del Rey, CA (USA). Inst. of Physics); Dorri, N.; Wang, M.; Szawlowski; Patt, W.K.; Hedman, B.; Hodgson, K.O. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 198-202 (Apr 1990). (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

This paper describes recent progress in the development of HgI_2 energy dispersive x-ray detector arrays for synchrotron radiation research and their associated miniaturized processing electronics. Deploying a 5 element HgI_2 array detector under realistic operating conditions at SSRL, an energy resolution of 252 eV FWHM at 5.9 keV (Mn-Kα) was obtained. The authors also report energy resolution and throughput measurements versus input count rate. The results from the HgI_2 system are then compared to those obtained under identical conditions from a commercial 13 element Ge detector array.

49326 Performance studies of a multiwire chamber, with 1 mm anode wire spacing, to be used for 2-D position-sensitive detection of x-rays. Mathieson, E. (Leicester Univ. (UK)); Smith, G.C. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 187-191 (Apr 1990). (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

experimental and theoretical studies have been made of the performance of a multiwire chamber, with 1 mm anode wire spacing, to be used for position-sensitive detection of x-rays. The chamber has a wire upper cathode, with the wires parallel to the anode wires. The studies have shown that, from considerations of the spacing and registration of the cathode wires, some useful improvements in performance can be obtained. These improvements concern both position modulation and gain modulation, normal to the anode wire direction.

49327 Design of thick apertures for high-resolution neutron penumbral imaging. Ress, D. (Lawrence Livermore National Lab., CA (USA)). *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 155-160 (Apr 1990). DOE Contract W-7405-ENG-48. (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

A general technique is presented for designing the thick apertures required to image penetrating radiation with high resolution. The new apertures are tapered in such a way that the radius of curvature varies inversely with distance from the source plane. The technique is used to design a high-resolution neutron penumbral-aperture microscope planned for the Nova laser. The design provides a resolution (determined by the sharpness of the aperture point-spread function) of { <=} 10 μm over a field of view of 150 μm. The point-spread function of these apertures is sufficiently isoplanatic and distortion-free to allow linear reconstruction of complex source distributions. The design is generally appropriate for similar imaging techniques, such as high-resolution neutron or gamma-ray pinhole imaging.

49328 A large-area, scintillation telescope for heavy ions. Piercy, R.B. (Mississippi State Univ., Mississippi State, MS (USA)); Agnvall, P.; Ramayya, A.V. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 148-151 (Apr 1990). (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The authors have designed and tested in the laboratory a large-area, scintillation telescope (LAST) for the detection of heavy ions. This dual, thin-film detector is to be used as a fast event trigger, ΔE and time-of-flight spectrometer at the focal plane of the Argonne fragment mass analyzer (FMA). The thin scintillator films in each of the LAST detector modules have dimensions of approximately 1 inch by 3 inches. This is large enough to completely cover the active area of the focal plane of the FMA. Preliminary measurements indicate that ΔE measurements in each of the foils taken alone or in conjunction with data from other detectors could be used to determine the nuclear Z of the transiting ions. The durability and excellent timing characteristics of plastic scintillators make the LAST detector particularly valuable for high rate applications such as secondary beams measurements.

49329 New scintillation materials for high energy physics applications. Kennedy, C. (Notre Dame Univ., IN (USA). Dept. of Physics); Baumbaugh, B.; Ditmire, T.; Puseljic, D.; Ruchti, R.; Ryan, J.; Baumbaugh, A.; Knickerbocker, K.; Kauffman, J. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 144-147 (Apr 1990). (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The authors discuss how they have been developing new organic dyes for use in scintillation materials for high energy physics experiments. Among the materials developed are Bipyridine Diol, MOPOM and DBTeM POPOP. The first material is a large Stokes' dye with fluorescence in the green. The latter two materials have spectral emission similar to POPOP and di-methyl POPOP, but with UV shifted absorption spectra. These materials maintain the high molar extinction coefficient of POPOP, but are more soluble in polystyrene---concentrations of 1% by weight have been readily achieved. Hence these materials may be used as primary dyes. The Stokes' shifts are sufficiently large that these materials can be incorporated in binary scintillators which could have important consequences for microtracking detectors in colliding beam and fixed target applications.

49330 An improved operating mode for a Si(Li) x-ray spectrometer. Madden, N.W. (Lawrence Berkeley Lab., CA (USA). Engineering Div.); Goulding, F.S.; Jaklevic, J.M.; Landis, D.A.; Rossington, C.S. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 171-176 (Apr 1990). DOE Contract AC03-76SF00098. (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

A new technique has been developed for restoring the charge to the feedback capacitor in charge sensitive preamplifiers. The method, termed transient-reset, was developed for use in very low noise Si(Li) x-ray spectrometers. It has proved valuable as a diagnostic tool for evaluating the noise components of the input circuit in these systems. The technique is described and compared with the pulsed-light and transistor-reset methods. To complement the charge restoration technique, a new configuration of Si(Li) x-ray detector with a very thin aluminum entrance window has been developed. Measurements of the effective window thickness are compared with similar results obtained on gold, nickel, and ion-implanted boron contacts.

49331 Experience in construction and testing of plastic limited streamer chambers. Ball, A.H. (Maryland Univ., College Park, MD (USA). Dept. of Physics and Astronomy); Bard, R.L.; Bensen, D.; Cates, C.; Colmer, J.D.; Floros, P.; Fritz, D.J.; Goldey, P.R.; Miller, W.W.; Norkin, D.T.; Rapp, P.; Rozmarynowski, P.; Lee, J.R.; San Sebastian,. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 225-229 (Apr 1990). (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

This paper describes the manufacture and testing of multi-cell limited streamer chambers destined for use in the hadron calorimeter of the OPAL detector at LEP. All operations, from chamber cathode coating to the testing of completed sub-assemblies, have been performed under the same roof. The experience gained is useful in highlighting procedures crucial to the successful construction of this type of detector.

49332 A versatile, programmable control and data acquisition system for complex integrated circuits. Kirsten, F.A. (Electronics Div., Lawrence Berkeley Lab., Berkeley, CA (US)); Haber, C. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 288-292 (Apr 1990). DOE Contract AC03-76SF00098. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The authors describe a versatile, user-friendly hardware/software system. It has been designed for facilitating the testing, characterization and application of complex integrated circuits intended for high- and low-energy physics instrumentation. The system consists of two CAMAC modules and a program generation and data analysis facility hosted by a VAX computer.

49333 High speed imaging with a tapped solid state sensor. Turko, B.T. (Electronics Engineering Dept., Lawrence Berkeley Lab., Berkeley, CA (US)); Fardo, M. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 320-325 (Apr 1990). DOE Contract AC03-76SF00098. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

A high speed camera with a solid state diode array sensor is described. 500 frames/second rates are achieved by dividing the 256 x 256 pixel array into eight sections. The detected photocharge is tapped in parallel from each section into independent signal processing channels. The circuits for video signal extraction and processing are described and data on measured signal-to-noise ratio, sensitivity and crosstalk are presented. Image artifacts are also discussed and the effectiveness of the sensor fast clear procedure for their elimination shown.

49334 The scalable coherent interface, IEEE P1596: Status and possible applications to data acquisition and physics. Gustavson, D.B. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 365-368 (Apr 1990). DOE Contract AC03-76SF00515. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

IEEE P1596, the scalable coherent interface (formerly known as SuperBus) is based on experience gained while developing Fastbus (ANSI/IEEE 960–1986, IEC 935), Futurebus (IEEE P896.x) and other modern 32-bit buses. SCI goals include a minimum bandwidth of 1 GByte/sec per processor in multiprocessor systems with thousands of processors; efficient support of a coherent distributed-cache image of distributed shared memory; support for repeaters which interface to existing or future buses; and support for inexpensive small rings as well as for general switched interconnections like Banyan, Omega, or crossbar networks. This paper presents a summary of current directions, reports the status of the work in progress, and suggests some applications in data acquisition and physics.

49335 A practical approach to ballistic deficit correction. Hinshaw, S.M. (Tennelec, Inc., Oak Ridge, TN (USA)); Landis, D.A. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 374-377 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The energy resolution of a germanium gamma-ray spectrometer is limited at high counting rates by the charge-collection characteristics of the detector. The variations in collection time are reflected in the recovered-signal amplitude of a quasi-Gaussian signal processor. A recent paper described a method of ballistic deficit correction based upon measurement of shifts in the time position of the shaped-signal peak. The difficulty is that the time shift is a small fraction of the signal duration. An alternative method of ballistic deficit correction is presented which relies instead on the relative amplitudes of the unipolar quasi-Gaussian signal and its bipolar first-derivative.

49336 A high rate FASTBUS silicon strip readout system. Swoboda, C. (Fermi National Accelerator Lab., Batavia, IL (USA)); Barsotti, E.; Bowden, M.; Christian, D.; DeMaat, R.; Fachin, M.; Gonzalez, H.; Hance, R.; Haldeman, M.; Hoff, J.; Larwill, M.; Rotolo, C.; Trendler, R.; Treptow, K.; Urish, J.; Walsh, D.; Ya *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 342-346 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

This paper describes a synchronous silicon strip readout system capable of zero deadtime readout at average trigger rates in excess of 1 MHz. The system is implemented in FASTBUS, uses pipelining techniques, and includes point-to-point fiberoptic data links to transmit detector digital data. Semi-custom ASIC chips are used to amplify, discriminate, and logically combine track data before encoding. This paper describes the overall system, each major FASTBUS module, and the functional aspects of the ASIC chips.

49337 A programmable multichannel correlation module for analyzing neutron multiplicities. Arnone, G.J. (Los Alamos National Lab., NM (USA)); Brunson, G.S. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 403-409 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

This paper reports on a CAMAC module for analyzing neutron multiplicities. Reduction in dead time over previous methods has been made possible by providing independent detector channels. The authors have achieved a considerable reduction in circuitry by utilizing RAM and PROM integrated circuits in a nonstandard fashion. Along with specially developed algorithms, the module has been able to successfully unfold overlapping multiplicity chains for count rates varying over three orders of magnitude.

49338 A multi-channel waveform digitizer system. Bieser, F. (Lawrence Berkeley Lab., CA (USA)); Muller, W.F.J. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 410-411 (Apr 1990). DOE Contract AC03-76SF00098. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The authors report on the design and performance of a multichannel waveform digitizer system for use with the Multiple Sample Ionization Chamber (MUSIC) Detector at the Bevalac. 128 channels of 20 MHz Flash ADC plus 256 word deep memory are housed in a single crate. Digital thresholds and hit pattern logic facilitate zero suppression during readout which is performed over a standard VME bus.

49339 Large coaxial germanium detectors. Goulding, F.S. (Lawrence Berkeley Lab., CA (USA)); Landis, D.A.; Hinshaw, S.M. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 417-423 (Apr 1990). DOE Contract AC03-76SF00098. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The use of a ballistic deficit corrector circuit that calculates and applies a correction on a pulse-by-pulse basis has been shown to improve the energy resolution of spectrometers using large-diameter coaxial detectors at high energies and high counting rates. The potential importance of this circuit in correcting for the loss in signal amplitude due to majority carrier trapping has also been recognized. This work has led to further approaches to improve performance. This paper describes experimental results that demonstrate the complex nature of the problem of simultaneously correcting for both types of loss and also explains the results. The proposed design of a signal processor that should achieve good simultaneous correction for both types of loss is discussed.

49340 A high speed, high gain preamplifier system for silicon strip detectors. Yarema, R.J. (Fermi National Accelerator Lab., Batavia, IL (USA)); Zimmerman, T. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 430-433 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

A high speed, high gain amplifier system has been designed for silicon strip detectors. The amplifier has been designed using a semicustom bipolar linear array. This paper focuses on a practical integration of this amplifier into a working system. To maximize board density and reduce cost a new, relatively inexpensive custom chip carrier was designed. The design approach could be useful for other custom or semicustom chip designs. Insight into the design of a 128 channel preamplifier circuit board for low noise and low crosstalk using the new carrier is presented. High channel density presents challenges in cabling. A relatively new high density cable with mass termination capability was used for transmitting signals from the preamp to the discriminator boards. As a part of the overall design, the approach taken for shielding of the detector, preamplifier cards, and output cables is discussed.

49341 High dynamic range discriminator for measurements with fragmented heavy ions. Llacer, J. (Lawrence Berkeley Lab., CA (USA). Engineering Div.); Landis, D.A.; Madden, N.W. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 457-462 (Apr 1990). DOE Contract AC03-76SF00098. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

This paper describes the design of an event discriminator with a practical dynamic range of at least 2000:1 and its application to measurements in fragmented heavy ion beams. Such beams are formed by particles with a wide range of values of dE/dx and the determination of fragment composition by a simple, portable instrument that can be used under a variety of experimental conditions requires the measurement of the dE/dx of all particles in a single experiment. Histograms of dE/dx vs. residual energy for a ^{20}Ne fragmented beam, showing events with Z ranging from 1 to 10 are shown.

49342 A monolithically integrated detector-preamplifier on high-resistivity silicon. Holland, S. (Lawrence Berkeley Lab., CA (USA)); Spieler, H. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 463-468 (Apr 1990). DOE Contract AC03-76SF00098. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

A monolithically integrated detector-preamplifier on high-resistivity silicon has been designed, fabricated and characterized. The detector is a fully depleted p-i-n diode and the preamplifier is implemented in a depletion-mode PMOS process which is compatible with detector processing. The amplifier is internally compensated and the measured gain-bandwidth product is 30 MHz with an input-referred noise of 15 nV/square root of Hz in the white noise regime. Measurements with an Am^{241} radiation source yield an equivalent input noise charge of 800 electrons at 200 ns shaping time for a 1.4 mm^2 detector with on-chip amplifier in an experimental setup with substantial external pickup.

49343 A high speed, low noise ASIC preamplifier for silicon strip detectors. Zimmerman, T. (Fermi National Accelerator Lab., Batavia, IL (USA)). *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 439-443 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

A first version Tektronix Quickchip semicustom ASIC preamplifier for silicon strip detectors was reported in Oct., 1988. An improved version, QPA02, has been designed which incorporates laser trimming of nichrome resistors as a means of compensating for chip resistance process variations, which affected the response of the first version. This allows chips with randomly varying resistance values to be trimmed to have a standard output pulse shape. The QPA02 also has improved performance specifications. This paper describes the design philosophy and specifications of the QPA02, and the test results.

49344 Development of a cryogenic dark matter detector. Shutt, T. (Lawrence Berkeley Lab., CA (USA). Physics Div.); Wang, N.; Cummings, A.; Sadoulet, B.; Barnes, P.; Emes, J.; Ross, R.; Giraud-Heraud, Y.; Rich, J.; Beeman, J.; Haller, E.E. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 547-552 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The authors report on their continuing development of a cryogenic dark matter detector. 60 keV gamma pulses with submicrosecond rise times have been observed in NTD germanium thermistors, consistent with our hot electron model. The authors have also developed a eutectic bonding method for attaching thermistors to a larger crystal, and discuss preliminary studies of the phonon transmission qualities of this technique. They report on the measurement of ionization created by particle interactions in a pure germanium crystal with applied bias fields as low as 1 V/cm.

49345 High pressure gas scintillation drift chambers with wave-shifter fiber readout. Parsons, A. (California Univ., Berkeley, CA (USA). Dept. of Physics); Edberg, T.K.; Sadoulet, B.; Weiss, S.; Wilkerson, J.; Hurley, K.; Lin, R.P.; Smith, G. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 541-546 (Apr 1990). Grant NGL05-003-497. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The authors present results from a prototype high pressure xenon gas scintillation drift chamber using a novel wave-shifter fiber readout scheme. They have measured the primary scintillation light yield to be one photon per 76 $\pm$ 12 eV deposited energy. They present initial results of our chamber for the two-interaction separation ($<$ 4 mm in the drift direction, $\sim$ 7 mm orthogonal to the drift); for the position resolution ($<$ 400 μm rms in the plane orthogonal to the drift direction); and for the energy resolution ($\Delta E/E$ $<$ 6% FWHM at 122 keV).

49346 A high-resolution SPECT system based on a microchannel-plate imager. Dilmanian, F.A. (Brookhaven National Lab., Upton, NY (USA). Medical Dept.); Weber, D.A.; Coderre, J.A.; Joel, D.D.; Shi, K.C.; Meinken, G.E.; Som, P.; Tang, Y.N.; Volkow, N.D.; Yee, C.; Brill, A.B.; Watanabe, M.; Inuzuka, E.; Oba, K.; Gerson, R.; Iida, H.; *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 687-695 (Apr 1990). DOE Contract AC02-76CH00016. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The authors have developed a high-resolution single-photon emission-computed tomography (SPECT) system for small-animal studies with ^{125}I. The SPECT camera uses a Hamamatsu microchannel-plate imager PIAS (photon-counting image acquisition system), a 0.7 mm thick NaI(Tl) plate, and a lead-glass parallel-hole collimator. The 15-mm diameter field-of-view (FOV) of the PIAS tube was enlarged by an optical fiber face-plate taper to provide a 26 mm camera FOV. Camera absolute sensitivity (counts detected/gamma photons emitted) is 2 x 10^{-5} for ^{125}I. The system provides an in-plane resolution of about 0.7 mm FWHM in the reconstructed image for a 15-mm radius of rotation. SPECT images from phantom studies and from organs in the rat and mouse provide examples of the resolving capacity of the system.

49347 Detector, shielding and geometric design factors for a high-resolution PET system. Digby, W.M. (California Univ., Los Angeles, CA (USA). Div. of Nuclear Medicine); Dahlbom, M.; Hoffman, E.J. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 664-670 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The authors have evaluated the resolution, efficiency and scatter rejection on a new high resolution PET system designed for animal studies which is based on a 2-D modular detector system. A digital positioning system was evaluated by testing different encoding methods. Tungsten inter-plane septa of different thicknesses and geometries were evaluated by Monte Carlo simulations and experiments. The detector system consists of a 6 x 8 array of BGO crystals coupled to 2 dual photomultiplier tubes (PMTs). The crystals are 3.5 mm wide with 4 mm spacing transaxially and are 6.25 mm long with 6.75 mm spacing axially. PMT outputs are digitized and Anger camera type logic is used to determine the X and Y location of the scintillation event.

49348 Design considerations for a single tube gamma camera. Yasillo, N.J. (Chicago Univ., IL (USA). Dept. of Radiology); Beck, R.N.; Cooper, M. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 609-615 (Apr 1990). (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

Many potentially practical applications for nuclear medicine diagnostic procedures are difficult or impossible to perform because of the physical size of existing mobile gama cameras. With the commercial availability of position sensitive photomultiplier tubes the development of an instrument ideally suited to these applications now appears to be practical. The authors have tested the major components necessary to construct such a camera and have proposed a circuit configuration designed to provide a high level of clinical performance in such a device. Spatial resolution and linearity data from a developmental prototype are provided.

49349 Constrained least squares filtering in high resolution PET and SPECT imaging. Hutchins, G.D. (Michigan Univ., Ann Arbor, MI (USA). Div. of Nuclear Medicine); Rogers, W.L.; Chiao, P.; Raylman, R.R.; Murphy, B.W. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 647-651 (Apr 1990). (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

Constrained least squares filtering is a technique which employs *a priori* tomograph response information for the filtering of projection data prior to the filtered backprojection of radionuclide distribution images. This paper describes a simulation study which evaluates the performance of this algorithm as a function of the sampling density within each projection of the radon transform. The results of this evaluation demonstrate that the efficient application of this algorithm requires higher sampling densities than are typically employed in high resolution PET and SPECT. Therefore, application of this algorithm requires software and/or hardware modification of the data acquisition sampling schemes employed in tomographic systems.

49350 Measuring PET scanner sensitivity: Relating count rates to image signal-to-noise ratios using noise equivalent counts. Strother, S.C. (Neurology Dept., Memorial Sloan-Kettering Cancer Center, New York, NY (US)); Casey, M.E.; Hoffman, E.J. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 783-788 (Apr 1990). (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

Sensitivity parameters derived from a plot of a scanner's true coincidence count (TCC) rates as a function of activity in a 20 cm cylindrical phantom have no direct link to image quality. Noise equivalent count (NEC) rate curves, which incorporate the noise effects of subtracting the randoms and scatter count components provide a direct link between image signal-to-noise ratios and the scatter, randoms and trues coincidence count rates. The authors have measured TCC and NEC curves with a standardized 20 cm diameter nylon cylinder for five different PET scanners with several scanner-collimator combinations. In addition, the authors have compared TCC and NEC curves on one scanner with those from an Alderson brain phantom.

49351 Accelerated image reconstruction for a cylindrical positron tomograph using Fourier domain methods. Stearns, C.W. (Massachusetts General Hospital, Boston, MA (USA). Physics Research Lab.); Chesler, D.A.; Brownell, G.L. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 773-777 (Apr 1990). (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The authors present a method to reconstruct projection images through assembly in the Fourier domain, rather than by backprojection. By bypassing the rate-limiting backprojection step of filtered backprojection, the new algorithm operates more quickly than previous methods. Fourier domain operations are also used to form forward-projected views of the imaged object; portions of these views are required to operate a full three-dimensional reconstruction using the cross-plane projection planes. These Fourier domain algorithms will form the basis for the reconstruction algorithm in PCR-II, a volumetric positron imager currently under construction at MGH.

49352 X-ray spectrometry in vivo a Si(Li)-NaI(T1) detector. Strauss, M.G. (Argonne National Lab., IL (USA)); Keane, A.T.; Reinke, S.A.; Pehl, R.H. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 859-867 (Apr 1990). DOE Contract W-31-109-ENG-38. (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

A new Si(Li)-NaI(Tl) spectrometer was developed for measurements of Ul x-rays from ^{239}Pu in lungs of exposed persons. The spectrometer consists of six large, cooled Si(Li) detectors mounted on edge to provide two windows, one facing the lungs and the other a NaI(Tl) scintillator for anticoincidence background suppression. The sensitive area of the array is 54.5 cm^2 and the FWHM resolution at 17 keV is 390 eV. The ambient background count rate per minute in the energy band of interest of the Si(Li)-NaI(Tl) detector is 0.13. This is < 1/4 of that of an equal-area HPGe detector and 1/15 of an equal-are phoswich. The sensitivity of this detector for ^{239}Pu approaches the maximum achievable, where the minimum detectable level is fundamentally limited by the lung geometry (signal) and the natural radioactivity in the human body (background). With this detector one can measure low level Pu in human lungs directly even in the presence of ^{241}Am. A spectrum of ZrK x-rays from ^{92m}Nb (simulating Pu), obtained from lungs of a human subject in vivo, demonstrates the detector performance.

49353 Test of the HISPET prototype. Del Guerra, A. (Naples Univ. (Italy). Ist. di Fisica); Conti, M.; De Pascalis, G.; Maiano, P.; Rizzo, C. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 817-822 (Apr 1990). (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The test of a small version of the high spatial resolution positron emission tomograph (HISPET) is presented. The HISPET prototype consists of two 50* 50 cm^2 multiwire proportional chambers with a 2 cm thick lead-glass drift space converter. A CAMAC acquisition system connected to a MAC II computer has been set up. Experimental data with a ^{22} Na pointlike source have been reconstructed with a 3-D filtered backprojection algorithm. A spatial resolution better than 9 mm (FWHM) and a quantitation capability at ± 10% have been measured.

49354 Survey instrument response to beta radiations. Swinth, K.L. (Pacific Northwest Lab., Richland, WA (USA)); Sisk, D.R. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 907-910 (Apr 1990). DOE Contract AC06-76RL01830. (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

Available survey instruments do not have the beta measurement characteristics needed for accurate dose rate assessments. Such instruments have severe angular and energy dependence. In addition, beta measurements often require corrections for the source geometry response of the detector to permit accurate assessments. Studies were performed to characterize present instruments and to determine optimum characteristics for a field instrument. Results of the studies were used to specify and procure an instrument with improved characteristics. The purpose of this paper is to describe the results of the studies and the design of the instrument.

49355 Neutron detection based on superheated materials. Sisk, D.R. (Pacific Northwest Lab., Richland, WA (USA)); Swinth, K.L.; Apfel, R.E. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 902-906 (Apr 1990). DOE Contract AC06-76RL01830. (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The environmental and radiation responses of the Active Personnel Dosimeter/Superheated Drop Detector (APD/SDD) combination

have been evaluated at the Pacific Northwest Laboratory (PNL) for the U.S. Department of Energy's Neutron Measurement and Evaluation Program. This paper provides results of the evaluation and discusses possible improvements for the current system. Radiation detection based on the radiation sensitivity of superheated liquids has been studied for some time. A liquid is superheated if it exists as a liquid at a temperature-pressure state normally associated with the vapor phase of that material. The liquid does not vaporize because there are no bubble nucleation sits in the sample. These sites usually exist in microscopic cracks on solid container surfaces, in crevices of imperfectly wetted solid particles suspended in the liquid, or as a result of the radiation-matter interaction producing a microbubble that is large enough for bubble growth to be thermodynamically favorable. By suspending small drops of superheated liquid in an immiscible, inert, impurity-free medium, potential for bubble nucleation by the first two mechanisms is eliminated. Therefore, each drop becomes a miniature radiation detector.

49356 Assessment of TFT amplifiers for a-Si:H PIXEL particle detectors. Cho, G. (Lawrence Berkeley Lab., CA (USA)); Conti, M.; Drewery, J.S.; Fujieda, I.; Kaplan, S.N.; Perez-Mendez, V.; Qureschi, S.; Street, R.A. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(3): 1142-1148 (Jun 1990). DOE Contract AC03-76SF00098. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The authors have investigated the application of thin film electronics technology to making a signal amplifier and readout circuit for amorphous silicon PIXEL particle detectors which can detect minimum ionizing particles. Characteristics of currently available TFTs are reviewed and preliminary designs of a-Si:H and poly-Si amplifiers for a 300 μm $\times$ 300 μm PIXEL array are proposed. Based on measurement of small signal parameters and noise spectrum of individual a-Si:H and poly-Si TFTs, the overall gain, time-response and signal-to-noise ratio are calculated.

49357 A sensitive multi-detector neutron counter used to monitor cold fusion experiments in an underground laboratory: Negative results and positive artifacts. Ewing, R.I. (Sandia National Labs., Albuquerque, NM (USA)); Butler, M.A.; Ginley, D.S.; Schiber, J.E. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(3): 1165-1170 (Jun 1990). DOE Contract AC04-76DP00789. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

We conducted a sensitive search for neutrons emitted from a comprehensive selection of cold fusion systems, both electrochemical cells and temperature-cycled deuterium gas-metal cells. The experiments were performed in an underground laboratory that permitted the detection of very low levels of neutron emission due to the greatly reduced cosmic ray background. The use of three independent neutron detectors to simultaneously monitor the test cells permitted a search for bursts of neutrons by triple coincidence and allowed the identification of spurious counts (not associated with neutron production) in individual neutron detectors. The neutron detectors consisted of ^{3}He gas proportional counters embedded in polyethylene moderator, with an overall efficiency of about 10 percent (10 counts per 100 emitted neutrons). None of the ore than thirty cold fusion systems that we investigated produced any detectable neutron emission, with an average statistical uncertainty of 5 neutrons per hour (one standard deviation). No significant neutron bursts were detected, with a coincidence efficiency of over 50 percent for bursts of 50 or more neutrons. Many of the observed spurious events closely resembled the neutron emission reported by others who monitored cells using only one detector at a time.

49358 Silicon microstrip electronics operating with 20 nsec FWHM signals. Kononenko, W. (Pennsylvania State Univ., University Park, PA (USA)); Newcomer, F.M.; Selove, W.; Van Berg, R. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(3): 1102-1114 (Jun 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

Silicon microstrip detector (SMD) systems of high speed, low noise, and low cost are needed for high-rate particle-physics experiments, particularly in fixed-target experiments. Semi-custom integrated-circuit preamplifiers and discriminators have been designed to operate at near single-bucket speed, i.e., to give signals, from an SMD, shaped to 15 or 20 nsec FWHM. The authors have made measurements of signal size, signal/noise ratio (S/N), and noise rate and signal efficiency versus discriminator threshold setting. The test setup used an SMD plane 300 microns thick with 50 micron strips, and used prototype ICs.

49359 Construction and testing of the SLD Cerenkov ring imaging detector. Cavalli-Sforza, M. (California Univ., Santa Cruz, CA (USA). Inst. for Particle Physics); Coyle, P.; Coyne, D.; Gagnon, P.; Williams, D.A.; Zucchelli, P.; Jacques, P.; Piano, R.; Stamer, P.; Whitaker, J.S.; Wilson, R.J.; Bean, A.; Caldwell, D.; Dubosceq, J.; *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(3): 1132-1141 (Jun 1990). DOE Contract AC03-76SF00515. Grant PHY88-13669;PHY88-13018. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The authors report on the construction of the Cherenkov Ring Imaging Detector (CRID) for the SLD experiment at the SLAC Linear Collider and the testing of its components. The authors include results from testing the drift boxes, liquid radiator trays, and mirrors for the barrel CRID. The authors also discuss development of the support systems essential for the operation of the CRID: gas and liquid recirculator systems and monitoring.

49360 Application of mathematical removal of positron range blurring in positron emission tomography. Haber, S.F. (Lawrence Berkeley Lab., CA (USA)); Derenzo, S.E.; Uber, D. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(3): 1293-1299 (Jun 1990). DOE Contract AC03-76SF00098. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The range of positrons in tissue is an important limitation to the ultimate spatial resolution achievable in positron emission tomography. In this work the authors have applied a Fourier deconvolution technique to remove range blurring in images taken by the Donner 600-crystal positron tomograph. Using phantom data, the authors have found significant improvement in the image quality and the FWHM for both ^{68}Ga and ^{82}Rb. These were successfully corrected so that the images and FWHM almost matched those of ^{18}F which has negligible positron range. However, statistical noise was increased by the deconvolution process and it was not practical to recover the full spatial resolution of the tomograph.

49361 Remote sensing of the thermosphere, plasmasphere, and exosphere. Chakrabarti, S. (California Univ., Berkeley, CA (USA). Space Sciences Lab.); Bush, B.; Cotton, D.; Gladstone, G.R.; Link, R.; Barbee, T.W. Jr. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(3): 1274-1279 (Jun 1990). Grants NAG-5-646;NAGW-1735. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The authors describe an instrument package to remotely measure thermospheric, exospheric and plasmaspheric structure and composition. This instrument will be flown aboard the second test flight of the Black Brant XII rocket with an expected apogee of $\sim$ 1300 km. The experiment package for this flight consists of a spectrophotometer to measure He I 584 Å, O II 834 Å, O I 989 Å, hydrogen Lyman β (1025 Å), hydrogen Lyman α (1216 Å) and O I 1304 Å transitions, and a photometer to measure the He II 304 Å emission.

49362 The shuttle activation monitor: A system for direct comparison of gamma-ray detector materials in a space environment. Haskins, P.S. (Florida Univ., Gainesville, FL (USA)); McKisson, J.E.; Ely, D.W.; Weisenberger, A.G.; Piercey, R.B.; Dyer, C.S.; Ramayya, A.V.; Camp, D.E. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(3): 1256-1263 (Jun 1990). (CONF-900143–: Institute

for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

An experiment system is described which was used to compare gamma-ray detector materials in a space environment. Two 3 in. x 3 in. scintillator detectors, NaI and BGO, were flown on the Space Shuttle Columbia August 8–13, 1989 as part of the shuttle activation monitor (SAM) experiment. The goals of this experiment were to compare the performance of the two detector materials in the same environment and to measure the variations in dynamic radiation background as a function of geomagnetic coordinates, amount of shielding, and type of detector material. Twenty-four hours of data in five-minute time bins were recorded with each detector in both high-shielding and low-shielding locations in the Orbiter middeck. The high-inclination orbit (57°, 160 nautical miles) provided exposure to the trapped charged particles in the South Atlantic Anomaly as well as the electrons in the polar regions. The system used specially adapted off-the-shelf hardware for data acquisition and storage. The multichannel analyzer was a commercially available unit with added circuitry to support an active particle shield. Data during the flight were stored using a cassette tape recorder. A preliminary look at some of the data from the first flight is presented.

49363 A new generation of SPECT and PET systems based on position sensitive photomultipliers. Singh, M. (University of Southern California, Los Angeles, CA (USA). Dept. of Radiology); Leahy, R.; Oshio, K.; Brechner, R.R.; Yan, X.H. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(3): 1321-1327 (Jun 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The design and image reconstruction aspects of a head SPECT, a body SPECT, and a body PET system, all based on 13 cm diameter position sensitive photomultiplier tubes (PSPMTs) have been investigated. Wobbling is introduced to improve the resolution of the head SPECT from 1.2 cm to 0.9 cm at 10 cm. By combining data from adjacent tubes, the resolution of the body ring SPECT is improved from 2.1 cm to 1.7 cm at 20 cm. Sampling gaps are reduced in the ring PET after one rotational increment. Results of computer simulation studies to reconstruct tomographic images from these systems are presented. The PSPMT based imaging systems greatly facilitate dynamic imaging and should lead to significant reductions in electronic components over existing systems.

49364 Multi-energy neutron detector for counting thermal neutrons, high-energy neutrons, and gamma photons separately. Chiles, M.M. (Oak Ridge National Lab., TN (USA)); Bauer, M.L.; McElhaney, S.A. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(3): 1348-1350 (Jun 1990). DOE Contract AC05-84OR21400. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

This scintillation detector is composed of two scintillators optically coupled and mounted on a single photomultiplier tube. The first scintillator is a ^{6}Li-loaded glass that has high efficiency for thermal neutrons, and the second is a liquid scintillator (BC 501) that has fairly high efficiency for higher energy neutrons. The ^{6}Li glass scintillator emits light with a characteristic time constant of ~ 60 ns, whereas light emitted in the liquid scintillator by proton recoil from energetic neutrons has a time constant of ~ 30 ns and the time constant for scintillations occurring from gamma-scattered Compton electrons in the liquid scintillator is ~ 3.7 ns. These differences in light decay time constants make this detector conducive to electronic separation of pulses generated by the three different radiations. The thermal neutrons, high-energy neutrons, and gamma radiation can be counted separately by operating this detector with a pulse-shape discriminator recently developed. Experimental data demonstrates the proof of principle of this dual scintillator detector for many applications.

4402 Radiation Effects on Instrument Components, Instruments, or Electronic Systems

Refer also to citation(s) 48899, 48940, 49283, 49286, 49399

49365 (IFVE-OEF–89-102) **Investigation of radiation stability of low-noise transistors.** Kurchaninov, L.L.; Rykalin, V.V.; Sarajkin, A.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 6p. (In Russian). Order Number DE91602608. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The radiation effect on the noise characteristics of bipolar transistors (current, gain, base resistance and an equivalent noise charge) is studied. Several types of transistors of radiation resistance have been compared. Change in noise characteristics is shown to be caused mainly by dose dependence of a gain factor. The level of the absorbed dose, that determining the boundary of transistor KT399 application in fields of mixed radiation of accelerators has been determined experimentally. The level is $5x10^{4}$ rad. For transistors KT3127, KT391 the dose level of 640 krad can be considered acceptable. 12 refs.; 3 figs.

49366 (IPPCZ–293/III, pp. 195-203) **Influence of 14-MeV neutrons and gamma radiation on optical fibers and optoelectronic devices.** Bielik, M. (Institute for Nuclear Studies, Otwock-Swierk (Poland)); Jerzykiewicz, A. Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. (CONF-890322–: 3. conference on solid-liquid separation practice, Bradford (UK), 29-31 Mar 1989). In *Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak".* Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The impact of the environment of a thermonuclear reactor on the reliability of optoelectronic equipment is discussed. An overall assessment of the radiation resistance of optical systems is done on the basis of published data. Special attention is paid to the influence of radiation on the transmission loss of fiber optic cables and on the parameters of LEDs, photodiodes and photomultipliers. The feasibility of diminishing the radiation-induced losses in optical fibers by using the discoloring technique is demonstrated. For adequate investigation of radiation resistance of optoelectronic components, two kinds of neutron sources are available at the Institute of Nuclear Studies, Swierk. (J.U.).

49367 (SAND–90-2173C) **A radiation hardened SONOS/CMOS EEPROM family.** Klein, V.F. (Harris Corp., Melbourne, FL (USA). Semiconductor Sector); Wood, G.M.; Buller, J.F.; Murray, J.R.; Rodriquez, J.L. Sandia National Labs., Albuquerque, NM (USA). [1990]. 3p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901124–2: Government microcircuit applications conference: technology strategies for the 90's, Las Vegas, NV (USA), 6-8 Nov 1990). Order Number DE90015993. Source: NTIS, PC A02/MF A01 - OSTI.

There has long been a need for fast read nonvolatile, rad hard memories for military and space applications. Recent advances in EEPROM technology now allow this need to be met for many applications. Harris/Sandia have developed a 16k and a 256k rad hard EEPROM. The EEPROMs utilize a Silicon-Oxide-Nitride-Oxide-Silicon (SONOS) memory transistor integrated into a 2 μm, rad hard two level metal CMOS process. Both the 16k and the 256k parts have been designed to interface with the Intel 8085 or 80C51 and National 32000 series microprocessors and feature page and block clear modes. Both parts are functionally identical, and are produced by the same fabrication process. They are also pin for pin compatible with each other, except for the extra address and ground pins on the 256k. This paper describes the characteristics of this EEPROM family. 1 ref.

49368 Optical data transmission at the superconducting super collider. Leskovar, B. (Electronics Engineering Dept., Lawrence Berkeley Lab., Berkeley, CA (US)). *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 271-287 (Apr 1990). DOE Contract AC03-76SF00098. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

Digital and analog data transmissions via fiber optics for the Superconducting Super Collider have been investigated. The state of the art of optical transmitters, low loss fiber waveguides, receivers and associated electronics components are reviewed and

summarized. Emphasis is placed on the effects of the radiation environment on the performance of an optical data transmission system components. Also, the performance of candidate components of the wide band digital and analog transmission systems intended for deployment of the Superconducting Super Collider Detector is discussed.

49369 Preliminary study of radiation damage in liquid scintillators. Zorn, C. (Florida Univ., Gainesville, FL (USA). Dept. of Physics); Majewski, S.; Wojcik, R.; Hurlbut, C.; Moser, W. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 487-491 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

An initial examination of radiation damage phenomenology in selected standard liquid scintillators has been made. The observed substantial drop in scintillation pulse height after exposures of several megarad from a ^{60}Co gamma source is attributed to radiation-induced absorption of the primary fluor's emission by the damaged solvent. Some new formulations show significantly greater radiation resistance.

49370 Study of plasma chemistry in wire chambers by GC/MS. Wise, J. (Lawrence Berkeley Lab., CA (USA)); Kadyk, J.A.; Hess, D.W.; Williams, M.C. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 470-477 (Apr 1990). DOE Contract AC03-76SF00098. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The authors have constructed an apparatus to allow systematic and detailed study of radiation-induced plasma-chemical reactions that may lead to wire aging. A proportional counter tube irradiated by an ^{55}Fe source is used as a model wire chamber. Less-volatile components in the tube effluent gas are concentrated by several orders of magnitude in a cryotrap to provide the sensitivity need for detection. Separation and analysis are performed by gas chromatography/mass spectrometry. A strong signal from many products formed in the avalanche by plasma-chemical reactions has been observed.

49371 Radiation effects on the SVX silicon strip readout chip. Yarema, R.J. (Fermi National Accelerator Lab., Batavia, IL (USA)); Amidei, D.; Bohn, T.; Zimmerman, T.; Ely, R.P.; Haber, C.; Kleinfelder, S.; Wester, W.; Vejcik, S. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 434-438 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

A study of radiation effects on early versions of the SVX silicon strip readout device has been completed. Test structures and full operating readout chips were exposed to Cobalt 60 gamma radiation and neutrons. Transistor threshold shifts and input noise density as a function of radiation are reported. Equivalent input noise as a function of radiation is also presented. In order to show the environment in which the SVX chip will operate and help interpret the radiation test results, measurements of radiation levels inside the CDF detector were made. These results are reported for the last CDF run.

49372 Effects of radiation damage to ionization chamber liquids. Holroyd, R. (Brookhaven National Lab., Upton, NY (USA). Chemistry Dept.). *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 513-522 (Apr 1990). DOE Contract AC02-76CH00016. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

Because of the high levels of radiation that will exist in the detector areas of the SSC it is important to understand how radiation effects calorimetry liquids. The results for tetramethylsilane, tetramethylgermanium, tetramethylpentane as well as methane-argon solutions are discussed. Tests have shown significant pressure buildup due to H_2 and CH_4. Also there is a loss of efficiency of charge collection at large radiation doses. In addition radiation products can change the drift velocity of electrons and the free ion yield. These results are reviewed and the importance of each discussed.

49373 Studies in the radiation resistance of plastic scintillators: Review and prospects. Zorn, C. (Florida Univ., Gainesville, FL (USA). Dept. of Physics). *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 504-512 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

With the planned construction of high-luminosity hadron colliders, the SSC and LHC, the issue of radiation resistance of detector components has arisen as a priority item. In this paper, a discussion of the radiation resistance of organic scintillators is given with the dual goals of presenting a review of the problem and pointing the way to possible solutions. Progress in the goal of producing sufficiently radiation-hard organic scintillators has been significant, but there remain many important details to be investigated.

49374 Measurement of proton induced radiation damage to CMOS transistors and PIN diodes. Ziock, H.J. (Los Alamos National Lab., NM (USA)); Hoffman, C.M.; Holtkamp, D.; Kinnison, W.W.; Milner, C.; Sommer, W.F.; Bacigalupi, J.; Cartiglia, N.; DeWitt, J.; Kaluzniacki, A.; Kolanoski, H.; Ritzl, D.; Rowe, W.A.; Sadrozinski, H.F.W.; Spencer, E.; Ten *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(3): 1238-1241 (Jun 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

As part of the authors' program to develop a silicon tracking device for the SSC they have exposed radiation-hard CMOS transistors and PIN diodes to the 800 MeV LAMPF proton beam. The fluences accumulated in a week corresponded to the expected radiation levels of about 10 SSC years. The authors determine the leakage current constants for PIN diodes and threshold voltage shifts for CMOS transistors under different biasing conditions.

4404 Well Logging Instrumentation

Refer also to citation(s) 49401

49375 Calculation of Monte Carlo importance functions for use in nuclear-well logging calculations. Soran, P.D. (Lawrence Livermore National Lab., CA (USA)); McKeon, D.C.; Booth, T.E. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 936-942 (Apr 1990). DOE Contract W-7405-ENG-48. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

Importance sampling is essential to the timely solution of Monte Carlo nuclear-logging problems. Achieving minimum variance (maximum precision) of a tool response in minimum computation time is one criteria for the choice of an importance function. Various methods for generating importance functions are presented; a new generation method is introduced; and, calculations using the different importance function generators are shown.

49376 MCNP capabilities for nuclear well logging calculations. Forster, R.A. (Los Alamos National Lab., NM (USA). Applied Theoretical Physics Div.); Little, R.C.; Briesmeister, J.F.; Hendricks, J.S. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(3): 1378-1385 (Jun 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The Los Alamos Radiation Transport Code System (LARTCS) consists of state-of-the-art Monte Carlo and discrete ordinates transport codes and data libraries. This paper discusses how the general-purpose continuous-energy Monte Carlo code MCNP (Monte Carlo neutron photon), part of the LARTCS, provides a computational predictive capability for many applications of interest to the nuclear well logging community. The generalized three-dimensional geometry of MCNP is well suited for borehole-tool models. SABRINA, another component of the LARTCS, is a graphics code that can be used to interactively create a complex MCNP geometry. Users can define many source and tally characteristics

with standard MCNP features. The time-dependent capability of the code is essential when modeling pulsed sources. Problems with neutrons, photons, and electrons as either single particle or coupled particles can be calculated with MCNP. The physics of neutron and photon transport and interactions is modeled in detail using the latest available cross-section data.

4405 Thermal Instrumentation

Refer also to citation(s) 48645

4406 Optical Instrumentation

Refer also to citation(s) 48394, 49366, 49368, 50235

49377 (CONF-9007167–1) **The photon scanning tunneling microscope.** Ferrell, T.L.; Goudonnet, J.P.; Reddick, R.C.; Sharp, S.L.; Warmack, R.J. Oak Ridge National Lab., TN (USA). [1990]. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From STM90'/Nano 1 conference; Baltimore, MD (USA); 23-27 Jul 1990. Order Number DE90017317. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper discusses the concept and energy resolution of the photon scanning tunneling microscope. (LSP)

49378 (IFVE-OMVT–89-42) **Fiber-optical systems in physical experiment technique. Part 1: Part 1: Concepts and components.** Vatutin, V.M. (Moskovskij Inst. Radiotekhniki, Ehlektroniki i Avtomatiki, Moscow (USSR)); Vagin, A.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 79p. (In Russian). Order Number DE91602597. Source: NTIS (US Sales Only), PC A05/MF A01; OSTI; INIS.

Analysis of fiber-optic systems (FOS) application in modern physical experiment automatization systems mainly oriented to functional monitoring electrophysical installations (EPI), beams, plasma, targets diagnostics as well as experiment environment investigation is considering. Questions of the FOS functioning in high and low pressure; high and cryogenic temperature; pulsed, SHF and radiational fields, high potentials are discussed. Attention is attached to designing, manufacturing and servicing FOS, their metrological support. There are functioning concepts of FOS, and modern component base: fiber and optical cabels, connectors, and couplers, spectral devices, optical sources and photodetectors, transmitter and receiver devices. 191 refs.; 19 figs.; 9 tabs.

49379 (SAND–90-1747C) **A Nuisance Alarm Data System for evaluation of intrusion detectors.** Ream, W.K. Sandia National Labs., Albuquerque, NM (USA). [1990]. 2p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901101–6: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE90013075. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A Nuisance Alarm Data System (NADS) was developed to gather long-term background alarm data on exterior intrusion detectors as part of their evaluation. Since nuisance alarms play an important part in the selection of intrusion detectors for use at Department of Energy (DOE) facilities, an economical and reliable way to monitor and record these alarms was needed. NADS consists of an IBM Personal Computer and printer along with other commercial units to communicate with the detectors, to gather weather data and to record video for assessment. Each alarm, its assessment and the weather conditions occurring at alarm time are placed into a database that is used in the evaluation of the detector. The operating software is written in Turbo Pascal for easy maintenance and modification. A portable system, based on the NADS design, has been built and shipped to other DOE locations to do on-site alarm monitoring. This has been valuable for the comparison of different detectors in the on-site environment and for testing new detectors when the appropriate conditions do not exist or cannot be simulated at the Exterior Intrusion Detection Testbed.

49380 (UCRL–98005) **Integrated optical modulators for analog signal transmission.** McWright, G.; Behymer, E.; Brazes, W.; Koo, J.; Lancaster, G.; Lowry, M.; Roeske, F.; Schumacher, F.; Tindall, W. Lawrence Livermore National Lab., CA (USA). [1988]. 7p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-48. (CONF-880384–2: DOD fiber-optics conference, McLean, VA (USA), 22-25 Mar 1988). Order Number DE90015914. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We discuss integrated optical devices for high speed analog signal transmission. Specifically, we focus on data transmission with lithium niobate modulators and also describe a novel gallium arsenide integrated optical structure for direct radiation detection. 3 figs.

49381 (UCRL–102842) **Sub-nanosecond intensifier gating using heavy and mesh cathode underlays.** Thomas, S. (Lawrence Livermore National Lab., CA (USA)); Shimkunas, A.R.; Mauger, P.E. Lawrence Livermore National Lab., CA (USA). 21 Jul 1990. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9009248–2: 19. international congress on high speed photography and photonics, Cambridge (UK), 16-22 Sep 1990). Order Number DE90017522. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Irising time of microchannel plate intensifiers with quartz cathode windows has been reduced to less than 100 ps. This is achieved by application of a metal underlay to reduce cathode substrata resistance. The first approach uses a 50%-transmissive uniform nickel heavy underlay, while the second approach uses a 96%-transmissive nickel mesh. For the heavy underlay, approximately 5 nm of nickel is evaporated over the cathode side of the quartz window. For the mesh underlay, approximately 750 nm of nickel is sputtered onto the window and coated with photoresist, which is exposed through a mask of 100-micron-square spaces defined by 3.5-micron-wide lines. The photoresist is developed and washed off, exposing the nickel covering the square areas. At this point, photoresist still covers the nickel over the 3.5-micron-wide wires, protecting them when the exposed nickel covering the squares is etched away. Removal of the remaining photoresist leaves only the nickel wires, which have been reduced to 2 microns in width due to sideways etching during removal of the squares. As a prototype effort, Lawrence Livermore National Laboratory (LLNL) purchased two 18-mm heavy underlay tubes from Hamamatsu Photonics and formed a mesh underlay on faceplates which Hamamatsu used for construction of two additional tubes. Measurements of irising time were made on these four tubes. Irising is characterized by a bright ring, seen first at the edge as it propagates toward the center. The time lag is caused by the distributed time constant of the substrata resistance and the cathode-to-MCP capacitance. Since the capacitance is fixed by restraints of tube geometry, our goal was to reduce the distributed resistance sufficiently to achieve sub-nanosecond irising times. Testing showed no irising on one tube of each type of underlay. 5 refs., 9 figs.

49382 (UCRL–102843) **Picosecond intensifier gating with a plated webbing cathode underlay.** Thomas, S.; Trevino, J. Lawrence Livermore National Lab., CA (USA). 21 Jul 1990. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9009248–1: 19. international congress on high speed photography and photonics, Cambridge (UK), 16-22 Sep 1990). Order Number DE90017521. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Irising time of microchannel plate intensifiers with fiberoptic cathode windows has been reduced to less than 100 ps. This is achieved by metalizing the fiberoptic's cladding glass to reduce cathode substrata resistance without reducing transmission of the cathode window. During irising, a bright ring is seen, first at the edge as it propagates toward the center. This time lag is caused by the distributed time constant of the substrata resistance and the cathode-to-MCP capacitance. Since the capacitance is fixed by restraints of tube geometry, our goal was to reduce the distributed resistance sufficiently to achieve sub-nano-second irising times. The process involves a number of steps. First, an approximately 34-nm-thick layer of nickel is evaporated over the cathode side of the fiberoptic window. Next, the nickel is coated with photoresist, which is exposed through the faceplate and the nickel, using the fiberoptics as a self-aligning mask. The photoresist is developed and washed off, exposing the nickel covering the active fiber area or core glass. At this point, photoresist still covers the nickel over the cladding glass or webbing, protecting it when the exposed

nickel covering the core glass is etched away. Finally, the remaining photoresist is removed, leaving only the nickel covering the fiberoptic webbing. We processed several 18-mm faceplates from ITT, Fort Wayne, Indiana, and ITT used the plates to construct intensifiers which we tested for irising time. Photographs, as well as computer processed 3-d images of the output showed no irising. This means that any irising that occurs is clearly faster than the time resolution of our measurement system (which is estimated to be less than 50 ps). 3 refs., 9 figs.

4408 Miscellaneous Instrumentation

Refer also to citation(s) 48980, 49103, 49123, 49187, 49558, 49634, 49652, 50127

49383 (IFVE-OP–89-127) **Digital Hall magnetometer.** Zaruchejskij, V.G.; Spirkov, V.I.; Shalunov, A.N.; Sharifullin, Z.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 5p. (In Russian). Order Number DE91602598. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

A digital Holl magnetometer assigned for magnetic field measurements in the range of 0.02-6.0 T is described. The relative measurement accuracy is 10^{-3}. The measurements are controlled by a built in microprocessor. 4 refs.; 1 fig.

49384 (IYaF–88-93) **Total emission current in one-chamber electron-optical converters.** Bagduev, R.I.; Beschastnov, P.M. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 14p. (In Russian). Order Number DE91602605. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

An analytic expression of summary emission current in one-chamber electron-optical converters (EOC), allowing one to conduct an investigation of rise of the background current depending on the valid signal flow, is presented. It is shown that such parameter as dark background brightness does not define EOC capabilities for recording low-energy and low-contrast radiations comletely. A substantial effect on the value of signal/background ratio is produced by the values of optical and ion feedback, increasing the background level in the operating regime. Dependences of relative background current on the signal levels are presented. 17 refs.; 3 figs.

49385 (LA-UR–90-2308) **Superconductor imaging surface magnetometry: Principles and applications.** Overton, W.C. Jr.; van Hulsteyn, D.B. Los Alamos National Lab., NM (USA). [1990]. 3p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-901130–2: 12. annual international conference of the IEEE Engineering in Medicine and Biology Society, Philadelphia, PA (USA), 1-4 Nov 1990). Order Number DE90015031. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We present in this paper the principles of superconductor imaging surface magnetometry. This new method should permit MEG and other weak field measurements without the necessity of an expensive magnetically shielded room. We report results showing signal to noise rejection ratios of 1/333,000 with simple apparatus. The goal of 1/1,000,000, seldom achieved by second order gradiometers, should be readily attainable in improved imaging magnetometers. 3 refs., 2 figs.

49386 (Y/IB–20) **An automated linearity test for direct voltage calibrators.** Endsley, R. Oak Ridge Y-12 Plant, TN (USA). 12 Apr 1990. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OS21400. (CONF-9008134–3: 1990 national conference of standards laboratories (NCSL) symposium and workshop, Washington, DC (USA), 19-23 Aug 1990). Order Number DE90016927. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The complete calibration of direct voltage calibrators should include a linearity calibration. The method described uses a string of thermally lagged resistors in series across a stable voltage source to provide fixed reference points for the calibration. A high-resolution digital multimeter is used to compare voltage increments in the output of the calibrator. The calibrator and the instruments in the linearity test system are controlled by computer via the IEEE-488 bus. The measured linearity is the result of standard ration techniques. The test is suggested not only as a general purpose technique, but also as a source of assistance in dealing with traceability questions arising over instruments employing "international calibration" routines. 7 refs., 2 figs., 2 tabs.

49387 Acoustic wave chemical sensors based on monitoring both velocity and attenuation. Frye, G.C. (Sandia National Laboratories, Albuquerque, NM (USA)); Martin, S.J. pp. 22, Paper ANYL 69 of American Chemical Society, Division of Analytical Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

Acoustic wave (AW) derives have the advantage over many other sensing transducers that there are two separate sensor responses that can be monitored simultaneously: wave velocity and wave attenuation. Sensor response due to changes in the viscoelastic properties of the sheet conductivity of a film overlaying the device surface results in detectable changes in both wave velocity and attenuation. The results of a study investigating the advantage of using chemical sensor coatings which provide both velocity and attenuation responses in surface acoustic wave and shear horizontal acoustic place model devices will be reported.

49388 Micro-mirrors for gas sensing. Butler, M.A. (Sandia National Laboratories, Albuquerque, NM (USA)); Ricco, A.J. pp. 28, Paper ANYL 91 of American Chemical Society, Division of Analytical Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

A new sensing concept will be described in which chemically induced reflectivity changes of an optically thin mirror on the end of an optical fiber are measured. Changes in reflectivity can detect both bulk and surface chemical reactions. Reactions studied include chemisorption of O_2 on Ni, H_2S, CO_2, and SO_2 on Ag, and Hg on Au. A model will be presented which describes how the reflectivity change varies with metal film thickness. This optical technique is used to measure the adsorption isotherm for Hg on Au and this data is analyzed using the BET equation. The use of microinterferometers made from plasma polymerized C_2F_4 films on fiber ends to detect volatile organic compounds will also be discussed.

45 MILITARY TECHNOLOGY, WEAPONRY, AND NATIONAL DEFENSE

Refer also to citation(s) 48394, 50244

49389 (AD-A–222850/0/XAB) **Dynamic properties of porous B_4C. Interim report.** Brar, N.S.; Rosenberg, Z.; Bless, S.J. Dayton Univ., OH (USA). Research Inst. 25 Jan 1990. 24p. Contract DAAL03-88-K-0203. (UDR-TM–89-15). Source: NTIS, PC A03/MF A01.

The sound speed in porous B4C (Boron Carbide) was measured and predicted on the basis of a spherical void model and a penny crack model. Neither model does well for porosity exceeding 10 percent. Measured values of Hugoniot elastic limit for porous B4C agree well with those predicted by the Steinberg's model. Measured transverse stress in the elastic range of B4C under 1-d strain condition agrees with the predictions.

49390 (AD-A–222972/2/XAB) **High-temperature superconductivity applications for electronic warfare and microwave systems. Final report, March 1988-March 1990.** Ryan, P.A. Air Force Wright Research and Development Center, Wright-Patterson AFB, OH (USA). May 1990. 21p. (WRDC-TR–90-1080). Source: NTIS, PC A03/MF A01.

The discovery in 1987 of high temperature superconductivity (HTSC) in ceramic oxide compounds has given the Electronic Warfare and Microwave community another technology to help reach some of their most demanding goals. The near term applications will be in passive microwave components, providing reduced insertion loss, smaller circuit and device size, and higher quality factor circuitry with less heat dissipation. Other applications are farther away and may not have even been conceived as of yet. All applications need to be assessed for their overall payoff compared to

conventional technology to determine if the benefits of using superconductivity warrant cryogenic cooling.

49391 (ORNL/M–1250) **Quality Assurance (QA) plan for the Airlift Deployment Analysis System (ADANS).** Loffman, R.S.; Truett, L.F. Oak Ridge National Lab., TN (USA). Sep 1990. 81p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90017500. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Development of the Airlift Deployment Analysis System (ADANS) at Oak Ridge National Laboratory (ORNL) began in 1986. When fully implemented in 1992, ADANS will provide Headquarters, Military Airlift Command with an automated airlift planning and scheduling system. ADANS will be operational through at least the year 2000. This Quality Assurance (QA) Plan will be used by the ADANS team at ORNL as a guide to ensure that the ADANS software development project results in a high-quality product completed on time and within budget. The Plan defines the program elements to be considered under QA management, the responsibilities of each individual concerned, the acceptance criteria, and a schedule for QA program element reviews. Forms for maintaining appropriate QA records are also included.

4501 Chemical Explosions and Explosives

49392 (LA–11907-MS) **Preparation and properties of 3-amino-5-nitro-1,2,4-triazole.** Lee, Kien-Yin; Storm, C.B. Los Alamos National Lab., NM (USA). Oct 1990. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE90018047. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A novel method for the preparation of 3-amino-5-nitro-1,2,4-triazole (ANTA) has been invented. The yield of ANTA by selective reduction of the ammonium salt of 3,5-dinitro-1,2,4-triazole with hydrazine hydrate is 94% to 96% under mild reaction conditions. There is no volatile hydrazine present at the end of the reaction as it is isolated as hydrazine hydrochloride. ANTA, a potential insensitive explosive, has a crystal density of 1.82 g/cm^3, and a positive heat of formation (ΔH_f) of 21.0 kcal/mol, and is thermally stable. The detonation velocity of ANTA, calculated at crystal density, is higher than that of triaminotrinitrobenzene. In addition to the preparation of ANTA, we have also synthesized a new hydrazinium salt of ANTA. 6 refs., 2 tabs.

49393 (SAND–90-1250) **Tethered rocket as a vehicle for penetration and impact testing: Development report.** Hansen, N.R. Sandia National Labs., Albuquerque, NM (USA). Jun 1990. 108p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE90014865. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

A new technique, called tethered rocket, has been developed for testing in the penetration and/or impact modes. The technique involves tethering a rocket-motor assembly to an earth-fixed pivot so that the resulting semicircular arc delivers a payload to a precise impact point. Discussions are presented which describe the analytical and experimental activities of the tethered rocket technique. A series of analytical models has been integral to the success of the tethered rocket development. The analytic results were verified by testing. The tests demonstrated the viability of the technique for penetration and/or impact testing. Also included is a discussion of potential applications of the method. 18 refs., 53 figs., 17 tabs.

49394 (UCRL–102942) **Description of a PC-based coupled "PER" theory/finite element method for calculating shaped charge jet characteristics.** Murphy, M.J. Lawrence Livermore National Lab., CA (USA). 24 Aug 1990. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9010190–1: 12. international symposium on ballistics, San Antonio, TX (USA), 30 Oct - 1 nov 1990). Order Number DE90017520. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A PC-based, coupled, PER theory/finite element method for calculating shaped charge jet characteristics is described in this paper. The methodology utilizes a finite element analysis approach to model explosive detonation and liner collapse combined with analytic equations to predict the resulting jet configuration. Several factors make this method a viable alternative to other procedures for calculating the jet configuration. 18 refs., 3 figs., 2 tabs.

49395 (UCRL-JC–104276) **Aluminum metal combustion in water revealed by high speed microphotography.** Tao, W.C. (Lawrence Livermore National Lab., CA (USA)); Frank, A.M.; Clements, R.E.; Shepherd, J.E. Lawrence Livermore National Lab., CA (USA). 6 Jul 1990. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-900756–40: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90017525. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In high explosives designed for air blast, cratering, fragmentation, and underwater applications, metallic additives chemically react with the oxidizer and are used to tailor the rate of energy delivery by the expansion medium. Although the specific mechanism for sustained metal combustion in the dense detonation medium remains in question, it is generally accepted that the fragmentation of the molten particle and disruption of its oxide layer are a necessity. In this study, we use high speed microphotography to examine the ignition of small 25–76 μm diameter and 23 mm long aluminum wires, rapidly heated by a capacitor discharge system, in water. Streak and framing photographs detailing the combustion phenomenon and the fragmentation of the molten aluminum were obtained over periods of 100 nsec–100 μsec with a spatial resolution of 2 μm. The wire temperature was determined as a function of time by integrating the circuit equation together with the energy equation for an adiabatic wire, and incorporating known aluminum electrical resistivity and temperature functions of energy density in the integration. In order for the aluminum to sustain a rapid chemical reaction with the water, we found that the wire temperature has to be raised above the melting temperature of aluminum oxide. The triggering mechanism for this rapid reaction appears to be the fragmentation of the molten aluminum from the collapse of a vapor blanket about the wire during its first oscillation. 14 refs., 9 figs.

4502 Nuclear Explosions and Explosives

Refer also to citation(s) 48851, 49462

49396 (AD-A–223108/2/XAB) **Laboratory particle-velocity experiments on rock from a USSR underground nuclear test site. Technical report.** Miller, S.A.; Florence, A.L. SRI International, Menlo Park, CA (USA). Feb 1990. 51p. Contract F19628-88-K-0051. (SCIENTIFIC–1). Source: NTIS, PC A04/MF A01.

Particle velocity histories were measured in spherical wave experiments performed in Sierra White granite (1) to test a technique for increasing the useful signal duration for experiments in small diameter cores obtained from the joint verification experiment (JVE) site, and (2) to determine the effects of the pore space condition on wave propagation and attenuation. The technique used to increase the useful signal duration involved inserting a 6-cm diameter core into a borehole drilled in a 16-cm diameter specimen of the same material. Records from experiments with and without the core/borehole interface showed no effect of this interface. This technique can be used on the 6-cm diameter JVE cores. Three experiments were performed to compare different initial pore conditions: (1) dry, (2) saturated with equal overburden and pore pressures, and (3) saturated with 11.7 MPa effective stress. Results showed that any effects of initial pore condition are within experimental scatter. Therefore, an initial effective stress is not needed for future experiments, and they will be performed saturated with equal overburden and pore pressures. These preliminary experiments were performed in preparation for the testing program to be completed in the next year, during which time we will perform experiments on rocks from the JVE site and in samples obtained from a potential analog site in Maine.

49397 (DOE/MA–0417P) **The Manhattan Project: Science in the Second World War.** Energy History Series. Gosling, F.G. US-DOE Office of Administration and Human Resource Management, Washington, DC (USA). History Div. Aug 1990. 66p. Sponsored by

U.S. DOE Office of Administration and Human Resource Management. Source: OSTI (Free of Charge).

"The Manhattan Project: Science in the Second World War" is a short history of the origins and development of the American atomic bomb program during World War II. Beginning with the scientific developments of the pre-war years, the monograph details of the role of the United States government in conducting a secret, nationwide enterprise that took science from the laboratory and into combat with an entirely new type of weapon. The monograph concludes with a discussion of the immediate postwar period, the debate over the Atomic Energy Act of 1946, and the founding of the Atomic Energy Commission.

49398 (IAEA-INFCIRC–380) **Request by the Resident Representative of Iraq.** International Atomic Energy Agency, Vienna (Austria). Apr 1990. 16p. Order Number DE91602654. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Hard copies are available in English and Arabic from IAEA Division of Publications, Distribution Unit.

The document contains three attachments. The first one presents a statement made by an Iraqi Foreign Ministry spokesman on April 2, 1990 in connection with the acquisition of high voltage capacitors from the American company CSI. The other two attachments contain the history of this business and some copies from the correspondence related to the trade.

49399 (MIC–90-03410/XAB) **Pulse-width dependent radiation effects on electronic components. Technical Note No. 89-33.** Cousins, T. Defence Research Establishment, Ottawa, ON (Canada). ©1989. 33p. Source: NTIS, PC EE07/MF E01.

In order to realistically simulate the effects of the prompt gamma-ray pulse associated with a nuclear weapon on electronics, an electron linear accelerator (LINAC) is often used. The pulse widths available from most LINACs are longer than the typical battlefield pulse. This report examines the effects of varying pulse widths on selected electronic devices and summarizes recent work at a variable pulse-width facility located at Chalk River Nuclear Laboratories.

49400 (UCRL-ID–104759) **A continuum tensile failure model with friction.** Rubin, M.B.; Attia, A.V. Lawrence Livermore National Lab., CA (USA). Aug 1990. 52p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90018006. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The objective of this report is to document improvements in the tensile failure model that has been implemented as Model 23 in the DYNA-2D computer code. In the following sections we document the equations used for Model 23 and describe various example problems that were used to help verify the implementation of equations in the DYNA-2D computer code.

49401 Environmental corrections for a neutron-induced gamma-ray spectroscopy logging system in an air-filled borehole. Hearst, J.R. (Lawrence Livermore National Lab., CA (USA)); Conaway, J.G.; Mathews, M.A.; Barber, J.W. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA)*, 37(3): 1367-1377 (Jun 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

When a nuclear explosive is tested underground, rock in the immediate vicinity of the explosion is heated to very high temperatures. If any of that rock contains carbonates (dolomite or calcite), these are dissociated and the carbon may combine with oxygen to form carbon dioxide, increasing the hazard of a delayed leak. The authors discuss how they are trying to adapt a commercial neutron-induced gamma-ray spectroscopy log to estimate carbonate content in emplacement (2–4-m diameter) boreholes at the Nevada Test Site. Such a log would test a much larger (and therefore presumably ore representative) sample than the few grams currently used in sample analysis and would be continuous rather than discrete.

4503 Nuclear Explosion Detection

Refer also to citation(s) 49407

49402 (AD-A–222186/9/XAB) **Stability of RMS Lg measurements and their potential for accurate estimation of the yields of Soviet underground nuclear explosions. Technical report, November 1989-31 January 1990.** Hansen, R.A.; Ringdal, F.; Richards, P.G. Royal Norwegian Council for Scientific and Industrial Research, Kjeller (Norway). 28 Feb 1990. 47p. Contract F49620-89-C-0038. (NORSAR-CONTRIB–415). Source: NTIS, PC A03/MF A01.

Data on underground nuclear explosions have recently become available from modern digital seismic stations installed within the Soviet Union and China. Observations of root mean square Lg-wave signals for Soviet underground nuclear explosions at the Shagan River test site in East Kazakhstan show that the relative amplitudes of the RMS signals at stations in Norway, the U.S.S.R. and China, are very similar for different explosions, the standard deviation of only 0.03 in magnitude. This is consistent with earlier observations comparing NORSAR and the Graefenberg array data, and the observed scatter is significantly lower than that reported from Nevada Test Site. In view of the excellent correspondence for Lg versus yield at Nevada, RMS has a potential for yield estimation with very high accuracy at Shagan River. The study shows: (a) selected stations in the U.S.S.R. and China, at regional distances, provide a much improved signal to noise ratio of the Lg phase for events at Shagan River, compared to NORSAR array data; (b) the scaling of RMS Lg amplitudes between different sized events recorded at the same single station site appears to be consistent with that of NORSAR, indicating a remarkable degree of precision in single station measurements of Lg signal; (c) RMS Lg amplitude measurements for the best of these stations may be made at 1.5 to 2.0 magnitude units lower than at NORSAR Graefenberg, allowing a much lower threshold for Lg based yield determination; and (d) P wave detection capabilities of these single stations do not match those of the NORESS and ARCESS arrays, thus teleseismic signals continue to be important for detection of small nuclear explosions.

49403 (AD-A–223148/8/XAB) **Regional discrimination of quarry blasts, earthquakes and underground nuclear explosions. Final report, 23 March 1987-22 March 1989.** Bennett, T.J.; Barker, B.W.; McLaughlin, K.L.; Murphy, J.R. S-Cubed, San Diego, CA (USA). 7 Apr 1989. 145p. Contract F19628-87-C-0093, ARPA Order-5307. (SSS-TR–89-10395). Source: NTIS, PC A07/MF A01.

The investigations conducted under this contract focused on analyses of the higher-frequency phases observed at regional distances from underground nuclear explosions, earthquakes, and commercial blasts. These analyses systematically compared the time-domain amplitude and spectral characteristics of the observed regional seismic signals in order to identify diagnostic differences which would be indicative of source type. The sources were located in three tectonic environments: (1) eastern North America, (2) southern Soviet Union, and (3) western United States. Each source environment provides a unique contribution to the regional discrimination problem. For these source regions digital data from several different high-quality seismic networks were analyzed. The data sources were the Regional Seismic Test Network (RSTN), the Eastern Canada Telemetered Network (ECTN), the Chinese Digital Seismic Network (CDSN), the Soviet/Natural Resources Defense Council (NRDC) network, and the Lawrence Livermore National Laboratory (LLNL) network.

4504 Nuclear and Radiological Warfare

49404 (AD-A–222642/1/XAB) **Nuclear-effects model embedded stochastically in simulation (NEMESIS) summary report. Technical paper.** Youngren, M.A. Army Concepts Analysis Agency, Bethesda, MD (USA). Nov 1989. 132p. (CAA-TP–89-8). Source: NTIS, PC A07/MF A01.

An analytic probability model of tactical nuclear warfare in the theater is presented in this paper. The model addresses major problems associated with representing nuclear warfare in the theater. Current theater representations of a potential nuclear battlefield are developed in context of low-resolution, theater-level models or scenarios. These models or scenarios provide insufficient resolution in time and space for modeling a nuclear exchange. The model presented in this paper handles the spatial

uncertainty in potentially targeted unit locations by proposing two-dimensional multivariate probability models for the actual and perceived locations of units subordinate to the major (division-level) units represented in theater scenarios. The temporal uncertainty in the activities of interest represented in our theater-level Force Evaluation Model (FORCEM) is handled through probability models of the acquisition and movement of potential nuclear target units.

4505 Strategic Defense Initiative

Refer also to citation(s) 49893

49405 (CONF-901104–1) **Potential for advanced thermoplastic composites in space systems.** Garvey, R.E. Oak Ridge National Lab., TN (USA). [1990]. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 22. international technical conference of the Society for the Advancement of Material and Process Engineering; Boston, MA (USA); 6-8 Nov 1990. Order Number DE90014447. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper provides rational for incorporating graphite/thermoplastic into future Strategic Defense Initiative space systems. Graphite/PEEK is compared with the best available graphite/epoxy materials, which today are graphite/1962 produced by Amoco and graphite/934 produced by Fiberite. A first-order comparison reveals similar performance between these classes of materials with respect to maximum stiffness, minimum gage, maximum damping and threat hardness. There are significant differences in the behavior of graphite/polyether ether ketone and graphite/epoxy with respect to the following characteristics: water absorption, condensible-volatile contents, space-environment effects, dimensional stability, weight-savings options, joining alternatives, and production costs. A comparison is also made between organic composites, such as graphite/PEEK, with other spacecraft structural materials, such as aluminum and beryllium (which are commonly used today). The differing requirements for each spacecraft component will determine which of these material options is best suited for the particular structural application. 35 refs., 8 figs., 2 tabs.

49406 (SAND–89-0423) **Reference concepts for a space-based hydrogen-oxygen combustion, turboalternator, burst power system.** Edenburn, M.W. Sandia National Labs., Albuquerque, NM (USA). Jul 1990. 40p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE90016692. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report describes reference concepts for a hydrogen-oxygen combustion, turboalternator power system that supplies power during battle engagement to a space-based, ballistic missile defense platform. All of the concepts are "open"; that is, they exhaust hydrogen or a mixture of hydrogen and water vapor into space. We considered the situation where hydrogen is presumed to be free to the power system because it is also needed to cool the platform's weapon and the situation where hydrogen is not free and its mass must be added to that of the power system. We also considered the situation where water vapor is an acceptable exhaust and the situation where it is not. The combination of these two sets of situations required four different power generation systems, and this report describes each, suggests parameter values, and estimates masses for each of the four. These reference concepts are expected to serve as a "baseline" to which other types of power systems can be compared, and they are expected to help guide technology development efforts in that they suggest parameter value ranges that will lead to optimum system designs. 7 refs., 18 figs., 5 tabs.

4506 Chemical and Biological

49407 (AD-A–222246/1/XAB) **Strategic Defense Initiative three reasons to stay the course. Individual study project.** Bleeker, H.J. Army War Coll., Carlisle Barracks, PA (USA). 12 Feb 1990. 32p. Source: NTIS, PC A03/MF A01.

President Reagan's Strategic Defense Initiative announced 23 March 1983 has had a profound effect on the shape the world has taken since that time. While there has been much talk that the system as envisioned by the president is impossible, this study examines three compelling reasons why we should continue forward with the research and development effort. The Strategic Defense Initiative has brought the Soviets to the bargaining table and made CFE a reality. The threat of nuclear and chemical proliferation makes the deployment of a defensive system a logical strategy. The cost of developing and deploying the Strategic Defense Initiative may not be as high as the critics propose if we can use SDI as the third leg of our strategic deterrent. The American people and the people of the rest of the world deserve better than living with the threat of extinction.

49408 (AD-A–222596/9/XAB) **Laser-Induced IR fluorescence spectra of simulant chemical threat agent and exhaust vapors. Technical report.** Bossoli, R.B.; Thomson, G.M. Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab. Apr 1990. 63p. (BRL-TR–3096). Source: NTIS, PC A04/MF A01.

Infrared (IR) fluorescence spectra have been measured for several agent/exhaust simulants illuminated by a slowly (10-200 Hz) chopped infrared absorption spectra when excited by a grating tuned 5 watt CO_2 (9 - 11 microns) laser. Utilizing a calibrated spectral measurement apparatus, the spectra are presented in terms of the actual quantity of fluorescence energy emitted from a unit volume of vapor and wavelength span for a given set of excitation conditions (laser wavelength, power, and chop frequency) and simulant pressure. The addition of air to small quantities (10 - 30 Torr) of the simulants quenches, but does not completely extinguish, the fluorescence. A linear increase in the infrared fluorescence intensity with laser chopping period is observed along with very slow (msec) rise and decay times of the fluorescence signal. These observations are attributed to the bulk heating of the vapor or vapor-air mixture along the laser beam path due to the slow chopping frequencies. These results indicate the possible utilization of laser-induced infrared fluorescence in remote sensing of chemical vapors of interest to the Army (agents/vehicle exhausts).

49409 (AD-A–222809/6/XAB) **Analysis of soil samples for chemical warfare agents: Canadian contribution to a multinational round-robin analytical exercise. Memorandum report.** D'Agostino, P.A.; Provost, L.R.; Sawyer, T.W.; Weiss, M.T. Office of Naval Material, Washington, DC (USA). Apr 1990. 35p. (DRES-SM–1331). Source: NTIS, PC A03/MF A01.

VX and two VX related compounds, diethyl methylphosphonate and bis(2-(diisopropylamino)ethyl) disulfide, were confirmed at the 2 to 40 micrograms/gram level as the principal components in three of four soil samples distributed by Finland as part of a multinational round robin exercise designed to evaluate laboratory methodologies. Several other compounds related to VX, were also identified in extracts of the soil samples. Keywords: Gas chromatography, Canada, Soil samples, Diethyl methylphosphonate, Mass spectrometry, Bis(2-(diisopropylamino)ethyl) disulfide, Bioassay, Defence research establishment suffield(dres), VX, Military chemical agents, International relations, Neuron, Tissue culture, Chemical agent detection.

49410 (AD-A–223073/8/XAB) **Application of high-frequency ventilation to treatment of chemical-warfare casualties: Animal and theoretical studies (application of high-frequency transtracheal jet ventilation to treatment of chemical-warfare casualties). Final report, March 1983-December 1986.** Abbrecht, P.H.; Bryant, H.J.; Kyle, R. Uniformed Services Univ. of the Health Sciences, Bethesda, MD (USA). Aug 1987. 39p. Contract MIPR-83MM3506. Source: NTIS, PC A03/MF A01.

The objective of this work was to evaluate the effectiveness of transtracheal jet ventilation in organophosphate-challenged animals. Preliminary studies were done in normal canines to define the effects of ventilator operating parameters on respiratory gas exchange. Nine normal dogs, anesthetized with sodium pentobarbital, were ventilated through an eight gauge cricothyrotomy cannula using a controller that allowed separate setting of drive pressure, duty cycle, and frequency. Arterial (partial pressure of oxygen) and (partial pressure of carbon dioxide) were measured after achieving steady state gas exchange at 15-22 different combinations of drive pressure, duty cycle, and frequency in each dog. There were slight increases in PaCO2 and larger decreases in arterial oxygen partial

pressure as frequency was increased from 10 to 200 cycles/min. Increases in drive pressure and duty cycle resulted in reductions in PaCO2 and increases in PaO2.

49411 (AD-A-223080/3/XAB) **Application of high-frequency ventilation to treatment of chemical-warfare casualties: Animal and theoretical studies. Annual report, 1 March 1984-28 February 1985.** Abbrecht, P.H.; Bryant, H.J. Uniformed Services Univ. of the Health Sciences, Bethesda, MD (USA). Mar 1985. 24p. Contract MIPR83-MM-3506. Source: NTIS, PC A03/MF A01.

The objectives of work done during the reporting period were: to determine whether dogs given 2 LD50 of soman could be resuscitated with a treatment protocol consisting of transtracheal jet ventilation and atropine administration; to determine the changes in arterial blood gas composition occurring during transtracheal jet ventilation following soman administration; to determine the soman-induced changes in lung and airway properties that cause the observed changes in arterial blood gas composition; to determine the changes in systemic and pulmonary hemodynamics following soman administration; and to investigate some of the changes in autonomic function that may be responsible for the observed hemodynamic changes.

54 ENVIRONMENTAL SCIENCES

Refer also to citation(s) 49151

49412 (ORNL/FTR-3742) **[Modeling of ecosystems]: Foreign trip report, August 21, 1990-September 4, 1990.** Post, W.M. III. Oak Ridge National Lab., TN (USA). 12 Sep 1990. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90017842. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The V International Congress of Ecology, sponsored by the International Association for Ecology (INTECOL), was held in Yokohama, Japan, August 23-30, 1990. The theme of the meeting was "development of ecological perspectives for the 21st century." INTECOL congresses held every 4 years, provide the primary mechanism for ecologists from around the world to share results of current ecological research. Over 2500 ecologists representing more than 70 countries attended. The program included plenary lectures, symposia, poster sessions, and field excursions.

49413 (RRTAC-89-2-Vol.1) **Proceedings of the conference Reclamation, a global perspective: Volume 1.** Walker, D.G.; Powter, C.B.; Pole, M.W. (comps.). Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. 450p. (CONF-890807--: Symposium on reclamation: a global perspective, Calgary (Canada), 27-31 Aug 1989; MICROLOG-90-03281). Source: PC Alberta Queen's Printer, Publications Office, 11510 Kingsway Ave, Edmonton, AB, CAN T5G 2Y5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

A conference was held to provide access to the most current information on land reclamation topics. Papers were presented on subjects including soil improvement, revegetation, effects of and impacts on reclamation, habitat mitigation, waterway reconstruction, and reclaiming various types of sites. In this volume of the conference proceedings, the papers are classified under the following broad headings: global perspectives; northern and high altitude reclamation; wildlife and rangeland reclamation; water and hydrology; herbaceous revegetation; woody plant revegetation and succession; and reclamation of industrial and urban sites, such as mines, factories, and waste disposal sites. Separate abstracts have been prepared for 5 papers from this volume of the conference.

49414 (RRTAC-89-2-Vol.2) **Proceedings of the conference Reclamation, a global perspective: Volume 2.** Walker, D.G.; Powter, C.B.; Pole, M.W. (comps.). Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. 462p. (CONF-890807--: Symposium on reclamation: a global perspective, Calgary (Canada), 27-31 Aug 1989; MICROLOG-90-03431). Source: PC Alberta Queen's Printer, Publications Office, 11510 Kingsway Ave, Edmonton, AB, CAN T5G 2Y5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

A conference was held to provide access to the most current information on land reclamation topics. Papers were presented on tailings disposal and mine reclamation, farmland restoration, sodic and saline materials and their effects, soil amendments, overburden revegetation, characteristics of mining wastes, and acid-generating materials. Separate abstracts have been prepared for 4 papers from this volume of the conference proceedings.

5401 Environmental Sciences, Atmospheric

Refer also to citation(s) 48097, 48099, 48148, 48151, 48155, 48160, 48372, 48373, 48374, 48440, 48442, 48450, 48499, 48500, 48502, 48648, 48746, 48774, 48775, 48776, 48777, 48778, 48798, 48799, 48800, 48801, 48829, 48833, 48842, 49051, 49361, 49574, 49583, 49584, 49589, 49603, 49606, 49607, 49608, 49611, 49614, 49615, 49616, 49617, 49619, 49620, 49623, 49624, 49625, 49626, 49627, 49630, 49631, 49632, 49636, 49638, 49737, 50062, 50248

49415 (AD-A-221955/8/XAB) **Calculating toxic corridors. Revision. Technical report.** Kahler, J.P.; Curry, R.G.; Kandler, R.A. Air Weather Service, Scott AFB, IL (USA). Apr 1989. 104p. (AWS/TR-80/003-REV). Source: NTIS, PC A06/MF A01.

Revision of report dated Nov 80, AD-A101 267.

Method for defining evacuation areas for accidental spills of toxic chemicals are presented. These spills can present serious health hazards to people exposed to excessive vapor concentrations downwind of the accident. An empirical diffusion equation is used to calculate the downwind hazard distance. The width of the toxic corridor, specified in angular degrees centered along the mean wind direction, is based upon the variability of the wind direction. Flexibility in estimating toxic corridor evacuation areas is allowed through a choice of four different methods involving the use of tables, nomograms, and a programmable calculator. Appendices present worksheets, example problems, procedures for determining meteorological units, a procedure for determining evaporative source strength, and other items.

49416 (AD-A-222753/6/XAB) **Task Order 2 enhanced preliminary assessment, Fort Douglas, Salt Lake City, Utah. Final report, October-December 1989.** Mirchandani, M.G.; Johnson, G.M.; Bove, L.J. Weston (Roy F.), Inc., West Chester, PA (USA). Dec 1989. 108p. Contract DAAA15-88-D-0007. Source: NTIS, PC A06/MF A01.

Original contains color plates; All DTIC and NTIS reproductions will be in black and white.

An enhanced preliminary assessment (PA) of air pollution was conducted at Fort Douglas (FD) under the Base Closure Program. FD is an active military installation located in Salt Lake City, Utah. The Fort consists of the U.S. Army and Navy Reserve Centers, family housing units, a military museum, a chapel, clubs, swimming pool, a cemetery and various other support buildings. 50.8 acres of the 119 acres owned by FD are proposed to be excessed. Based on information obtained during the onsite visit and from available drawings and reports, three environmentally significant operations (ESOs) have been identified. These include asbestos, radon and transformers. No immediate action has been recommended for any of the ESOs. Site investigations have been recommended for asbestos and the transformers. A radon sampling program is currently underway at FD. This radon sampling program is being conducted by Fort Carson; the results should be evaluated as they become available, and the appropriate actions taken.

49417 (AD-A-222754/4/XAB) **Task order enhanced preliminary assessment, New Orleans Military Ocean Terminal, New Orleans, Louisiana. Final report, October-December 1989.** Weston (Roy F.), Inc., West Chester, PA (USA). Dec 1989. 96p. Contract DAAA15-88-D-0007. Source: NTIS, PC A05/MF A01.

Original contains color plates: All DTIC and NTIS reproductions will be in black and white.

A preliminary assessment was conducted at the New Orleans Military Ocean Terminal (New Orleans MOT), which is planned for

inclusion in the Base Closure Program. New Orleans MOT is located at the intersection of the Mississippi River and the Inner Harbor Navigation Canal within the corporate limits of New Orleans, Louisiana. No environmentally significant operations (ESOs) were observed during the site visit on 24 October 1989 or during follow-up interviews that would require immediate action. A geophysical survey is recommended to confirm the presence of three possible tanks on the property. All transformers should be tested for polychlorinated biphenyls. Asbestos sampling is recommended for all buildings. Soil samples should be obtained along existing and prior rail lines and near the vehicle wash rack. The sediments under the berths should be sampled. The objective of the sampling is to detect possible contamination from past releases.

49418 (ANL/EAIS/TM–17, pp. 1.3-1.5) **Opening remarks on behalf of the East-West center.** Ginsburg, N. Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

This meeting constitutes another milestone in the evolving relationship between the Environment and Policy Institute (EAPI) of the East-West Center and Argonne National Laboratory. In early 1983, a major study was undertaken of environmental issues relating to overland coal transportation. Consequently, two conferences were held, one in India and one in China, with appropriate publications. In early 1987, the Pacific Basin Consortium for Hazardous Waste Research came into being. This immensely significant institution is a joint project among Argonne, the East-West Center, and the Energy and Minerals Research Organization of Taiwan; membership in the Consortium now numbers about 30 institutions from around Asia and the Pacific. In February of 1988 and April of 1989, Pacific Basin Conferences on Hazardous Waste were held under the auspices of the Consortium, the first in Honolulu and the second in Singapore. The present conference represents another stage in the development of the institutional relationship, and it signifies a convergence of interests on a major environmental topic at a global scale as well as a regional scale. On the physical side, there is much uncertainty as to the extent of climatic change and particularly global warming; but on the socioeconomic side, there are even more questions about the implications of the trends that appear to exist. Although the received wisdom is that the consequences are bound to be negative, there also is a positive side to be considered. Warming in all likelihood means more precipitation. This could mean more moisture in currently moisture-deficient regions, such as northwest China and Soviet Central Asia. The effects on agriculture could be immense, and many might be positive. In EAPI's Ocean Yearbook 7 several papers also appear on comparative problems of coastal zone management, of China, Vietnam, Sri Lanka, and Japan's Inland Sea.

49419 (ANL/EAIS/TM–17, pp. 1.7-1.9) **Opening remarks on behalf of Argonne National Laboratory.** Drucker, H. Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

The subject of this meeting is vital to the future well-being of all countries of the Pacific and Asian region – including the United States. We have a cooperative agreement with the East-West Center in the areas of risk assessment and hazardous waste management and that now turns its attention to the problems of global climate change. Argonne's long-range planning goals mirror national R&D policy objectives, one of which is the provision of low-cost, reliable, and safe energy. At the same time we must take into account another national objective, namely, the preservation of environmental quality. Both goals must be balanced in the search for acceptable future energy supplies. Energy production is currently the primary contributor to greenhouse warming. By combining the emissions of greenhouse gases from each activity worldwide with the radiative properties of each chemical compound, the U.S. Environmental Protection Agency has estimated that energy production and use is responsible for about 57% of the problem. It overshadows the use of chlorofluorocarbons (17%), land use modification (9%), and other activities. Most of this energy contribution is the result of emissions of carbon dioxide from the combustion of fossil fuels for electricity generation, industrial production, and transportation. Many promising new energy technologies are under development at Argonne. The United States is currently the largest contributor to Greenhouse warming of all nations, contributing about 21% according to EPA's study. The Asia/Pacific region embodies many facets of the issue and reflected a range of potential national opinions and policies concerning remediation measures. In the region are those fully industrialized countries, rapidly developing countries and several island communities of the Pacific and South Asian seas.

49420 (ANL/EAIS/TM–17, pp. 2.1-2.18) **Atmospheric trends and emissions of greenhouse gases.** Edmonds, J. (Battelle Pacific Northwest Lab., Washington, DC (USA)); McDonald, S.; Wuebbles, D. Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

The current interest in the greenhouse issue stems from the observation that the concentrations of such gases as CO_2, CH_4, N_2O, $CFCl_3$ and CF_2Cl_2 have been increasing (Table 1). Changes in the concentrations of these gases hold the potential for changing the Earth's climate. In the discussion that follows, we will examine recent and long-term trends in the atmosphere, and the current understanding of the sources of the most important radiatively important gases released as a byproduct of human activities. These gases are: CO_2, CH_4, N_2O, CFCs, and CO. In addition we will discuss the current outlook for future emissions of these gases. This suite of gases includes both the greenhouse gases as well as those gases which can either directly or indirectly affect the Earth's energy balance. We will not discuss the sinks of these gases and the sources and sinks of other radiatively important gases, which originate in atmospheric processes, as these questions are too substantial to be treated within the confines of this review. 17 refs., 1 fig., 5 tabs.

49421 (ANL/EAIS/TM–17, pp. 2.19-2.36) **Global warming, tropical cyclones and ENSO [El Nino - Southern Oscillation].** Nicholls, N. (Bureau of Meteorology Research Centre, Melbourne, Victoria (Australia)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

Tropical cyclones and the El Nino - Southern Oscillation (ENSO) are the most important climatic threats to the Pacific-Asia region. The behavior of these two phenomena will, most likely, be altered by global warming due to an enhanced greenhouse effect. Prediction of how much their behavior will be altered, and the direction of these changes, is difficult. There have been predictions that global warming, by warming the ocean surface, may lead to more intense cyclones, longer cyclone seasons, cyclone formation at higher latitudes than at present, and increased numbers of cyclones. Some but not all the available evidence supports these predictions. Cyclone frequency and intensity have not increased in recent decades even though global warming has been observed. Also, the positive correlations expected between ocean temperatures and cyclone numbers, if warmer oceans lead to increased activity, are largely absent. If cyclone activity does increase the change should be gradual and, initially, small relative to present-day variations in cyclone activity from year-to-year. It should be several decades before these changes can be unambiguously separated from natural variability. One complicating factor in the prediction of tropical cyclone behavior is ENSO which affects tropical cyclone formation in the Pacific-Asia region. If global warming led to an increase in ENSO events, for instance, this might reduce the numbers of tropical cyclones in the west Pacific. A prediction of ENSO's reaction is also needed for areas where the phenomenon can result in severe droughts or floods. Most such areas are in the

Asia-Pacific region. Methods proposed for predicting how ENSO might respond to global warming are flawed and produce conflicting answers. There seems no basis yet for predicting how ENSO will react. A few strong ENSO events have exaggerated the apparent global warming of the last decade. 23 refs., 8 figs., 2 tabs.

49422 (ANL/EAIS/TM–17, pp. 2.37-2.41) **Developing countries and climate change: implications for risk management.** Smith, K.R. (Environment and Policy Institute, Honolulu, HI (USA)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

The potential in developing countries for large percentage increases in emissions of greenhouse gases (GHG) over the next decades has resulted in suggestions that control over such emissions should be considered as part of near term development planning. Some hope that such restrictions can be part of a win-win strategy, i.e. that concerns over global warming only lead us to take on programs such as reforestation, energy efficiency, and fuel switching, which we would be well advised to undertake. Does the threat of climate change through GHG emissions justify efforts to alter the development pathway now being followed in poor countries? Many observers apparently believe that the implications of global warming are so grave that restrictions on GHG emissions should be considered along with the other numerous and already burdensome restrictions on development, e.g. lack of capital, lack of skilled personnel, and lack of infrastructure. This paper, although accepting that the threat is important enough to warrant changes in present development pathways, draws the opposite conclusion. Rather than impose new constraints, it takes the position that the potential for global warming is actually one of the strongest arguments for reducing constraints and accelerating development. From the standpoint of the poorest two-thirds of the population in developing countries, concerns about climate change probably justify a policy response in which not only do GHG restrictions have no place, but GHG emissions rates may actually be stimulated locally. To reach this conclusion; it is argued that the best way to protect the poorest groups is to bring them to a minimum level of development at which they can be expected to adequately handle environmental stress. Also, that the extra GHG emissions involved are minuscule in the global GHG picture and thus will not be critical in climate change. 9 refs., 1 tab., 2 tabs.

49423 (ANL/EAIS/TM–17, pp. 2.43-2.49) **Priority setting of strategies for limiting global warming.** Lewis, S.J.L. (National Cheng Kung Univ., Taiwan (China)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

Despite considerable uncertainty regarding the magnitude of global warming, its timing, and the regional patterns of changes and impacts, the scientific community shares recognition of the increasing greenhouse gas concentrations, the inevitable trend of global warming, and concerns for actions to ease this global threat. Appropriate strategies to slow down emissions of greenhouse gases may allow us to buy the time we need to be better equipped for this challenge. This study aims to develop a methodology to gather interdisciplinary input regarding strategic priority setting for limiting global warming. A questionnaire utilizing pairwise comparison and matrix methods was designed to assess the priority of limiting strategies and to determine the feasibility of implementary mechanisms. The Delphi technique was employed by sending the questionnaire to 150 professionals in 30 different countries. This questionnaire, though rudimentary in form, can serve as a springboard to develop a consensus buildup, regarding appropriate strategies for dealing with global warming, from a wide geographic distribution of experts and decisionmakers.

49424 (ANL/EAIS/TM–17, pp. 2.57-2.59) **Report of working group D: Priorities for research in risk management.** Edmonds, J.; Glantz, M.; Harris, T.; Yueh Cheun Ho, P.; Kenski, D.; Kelveno, C.; Nicholls, N.; Nishioka, Shuzo. Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

There are three major areas of climate-change research: human consequences, emissions, and climate response. This paper focused on human consequences with the general premise that there is need to generate awareness among professionals and decision makers about the impacts of climate variability and change on development, particularly among poor populations in developing countries. It is necessary to conduct case studies that are specific to national and regional concerns rather than being generalized or global. Studies are recommended as follows: Historical analogy, although imperfect, can be a useful guide to what may happen in the future. Care should be taken to examine regional as well as local impacts through such mechanisms as a shift in international markets. Several examples of these types of studies are suggested. (a) Experience with actual natural disasters such as floods, droughts, and hurricanes can be reviewed, not only to see how such events directly affect people but also how well local and national institutions responded and how development plans may have been altered as a result. The premise is that decision makers already recognize many of the problems created by these events and will respond well to evaluations of future requirements based upon them. (b) Experience with how the media, decision makers, and others have responded in the past to scientific predictions of disasters can form the basis of evaluations of how risk communication can best be performed in the future. This experience can be useful, whether or not the predictions were borne out and whether or not there was any actual response. (c) An evaluation of the evolution of risk assessment capability in the insurance and other industries would provide valuable information for governments and other public bodies now attempting to make decisions under uncertainty.

49425 (ANL/EAIS/TM–17, pp. 2.51-2.55) **Global climate change and activities of UNEP [United Nations Environment Programme].** Onogawa, Kazunobu (United Nations Environment Programme, Bangkok (Thailand)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

The problem of global climate change including the green house effect has become one of the most serious political issues in the world and numbers of meetings and seminars are being held for this problem. This paper introduces some United Nations Environmental Program (UNEP) activities with particular attention to the activity in Asia and the Pacific Region. The activities of the Intergovernmental Panel on Climate Change (IPCC) are outlined. Actions proposed by the Fifteenth Governing Council (GC) of UNEP are discussed. UNEP studies and objectives for the region are briefly discussed. The Asia and Pacific region countries are divergent in climates and conditions and widely scattered, with, tropical and moderates zones, island and in-land countries, dessert area and tropical forests, developed and developing countries. It is the most rapidly growing region in the world containing over half of the world's population, and involves all types of environmental issues which have been designated as areas of special interest for UNEP.

49426 (ANL/EAIS/TM–17, pp. 3.1-3.17) **Implications of climate change for energy policies in Asia.** Siddiqi, T.A. (Environment and Policy Institute, Honolulu, HI (USA)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

This paper summarizes the relative importance of different gases in terms of contributing to global warming, and then focuses on efforts to reduce the one most directly related to energy use, i.e. carbon dioxide. According to current estimates carbon dioxide is responsible for about half of the Greenhouse warming at present.

The contributions of other gases are shown. Also discussed is the present energy use in Asia, and possible changes in the relative importance of different sources of energy on that continent in response to climate change concerns. Discussion covers: (1) major implications of the disparity in energy use and levels of affluence, (2) policy options for Asia, (3) sources of commercial energy in Asia, and (4) designing of energy policies for reducing carbon dioxide emissions. 15 refs., 7 figs., 1 tab.

49427 (ANL/EAIS/TM–17, pp. 3.19-3.35) **Future coal use in the Asia/Pacific region.** Doyle, G. (Financial Times International Coal Report, London (England)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

Coal the worlds most abundant fossil fuel is often credited as the fuel that will bridge the gap between oil running out and the emergence of clean safe and cheap sunbeam or fusion energy. While this is too simplistic a picture, since coal is unlikely to ever be as pervasive as oil in the economy, it does indicate that analysts expect that coal will play a crucial role in the future but also one that will be temporary. The increasing concern regarding the impact of CO_2 emissions underlines the latter point. This paper examines the future use of coal in the Asian Pacific Rim countries up to the mid 21st century. Reflecting the compounding of uncertainties with time, a distinction is made between the comparatively predictable near term, up to 2000, and the much fuzzier long term outlook beyond 2000. We examine where growth is likely to occur and the critical issues affecting use. The pivotal role of China within the region is stressed. 8 refs., 10 tabs.

49428 (ANL/EAIS/TM–17, pp. 3.37-3.53) **Future patterns of electricity generation in Asia: Competing fuels and competing objectives.** Fridley, D. (Resource Systems Institute, Honolulu, HI (USA)); Totto, L. Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

Low energy prices have played a major role in bringing about the economic recovery in the developed world and spurred a number of developing countries, notably in Asia (Korea, Taiwan, Thailand, and Singapore) to enviable rates of economic growth. Furthermore, lower oil prices have challenged the financial outlook of many energy diversification programs, particularly those of interfuel substitution in the power sector. With cheap energy available from a number of sources, and the sharp rise in activity in the industrial sector, concern for the quality of life and the environment has again become a critical variable in the policy equation. Decisionmakers must again find a balance among a number of competing priorities, e.g., economic development and growth, security of energy supplies, environmental protection and safety. Costs incurred by fuel diversification and substitution policies were acceptable to ensure energy security during the period of high oil prices in the late 1970s and early 1980s. With the collapse of oil prices in 1986, policymakers have begun to rethink their energy security policies in view of the 50% lower prices for fuel oil. Countries such as Japan, New Zealand, and Thailand already have dual-firing capability in some power plants allowing them to switch to oil when the price becomes competitive with coal (or gas). Other countries such as Korea and Taiwan have considered scrapping plans for nuclear plants in favor of oil-fired (or more likely coal/oil dual-fired) plants in the future. The purpose of this paper is to: (1) provide some background on the present national plans for interfuel substitution in the electricity sector in Asia and the implications of these policies on global warming; and (2) suggest a method of analysis to assist decisionmakers in designing policies that are technically and financially feasible and take into account competing national objectives. 6 figs., 6 tabs.

49429 (ANL/EAIS/TM–17, pp. 3.55-3.85) **US energy use: New technologies and policies in response to global warming.** Streets, D.G.; Bloyd, C.N.; Kenski, D.M. Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

Energy use and production accounts for by far the largest portion of emissions of greenhouse gases in the United States and the world. The U.S. Environmental Protection Agency (EPA) has estimated that, worldwide, these activities were responsible for 57% of greenhouse warming in the 1980s. Other activities and their respective contributions as shown in Fig. 1 include agriculture, 14%; land use and modification, 9%; chlorofluorocarbon (CFC) use, 17%; and other (nonenergy) industry, 3%. Given this importance of energy activities, it is appropriate that efforts to forestall global warming have focused on these activities. A number of U.S. government responses to global warming have been proposed or are now under way. For example, the 101st Congress has seen 11 bills dealing with global warming issues; a research program on climate change has been promised $190 million for 1990; and the United States has signed the Montreal Protocol to control CFCs. Despite these positive actions, it is important to note that none of the proposed bills has been signed into law. This paper discusses U.S. energy use and related emissions of greenhouse gases. Energy use in each sector is briefly characterized, and several new technologies for energy use in that sector are described. Finally, national and state policies that offer potential to reduce energy use are discussed. This discussion is limited to a sampling of the many technologies under development and policy options that have been proposed. 22 refs., 11 figs., 6 tabs.

49430 (ANL/EAIS/TM–17, pp. 3.87-3.91) **Climate change and energy use: Role of renewable energy sources.** Higgins, E.C. (Univ. of Hawaii, Honolulu (USA)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

This paper briefly discusses the world potential and status of renewable energy utilization. Hawaii has become the U.S. test bed for many of the renewable energy technologies. The status of some of these projects is briefly presented.

49431 (ANL/EAIS/TM–17, pp. 3.93-3.96) **Report of working group C: Priorities for research in energy policies.** Chung, F.; Coppock, R.; Doyle, G.; Engi, D.; Foell, W.; Garcia, L.; Higgins, E.C.; Hillsman, E.; Lewis, S.L.; Onogawa, Kazunobu; Pearman, G.; Winkelmann, H.P. Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

During the period of high oil prices between the early 1970s and the mid-1980s, Asian-Pacific countries vigorously pursued a policy of national energy development aimed at increasing the resilience of their economies to externalities. This policy combined numerous measures, notably including (a) a shift from oil to coal; (b) development of natural gas in a number of countries; (c) introduction of nonconventional energy technologies, particularly in reference to rural areas; (d) promotion of energy conservation programs; (e) rationalization of energy price structures and institutional mechanisms; and (f) a cautious exploration of the nuclear energy option. While significant variances continue to exist among countries of the region in terms of their energy intensity ratios (Japan and the newly industrialized economies (NIEs) faring better than the low income countries), overall there has been a lessening of dependency on oil. Consequently, use of coal and renewable energy sources has increased. With lower oil prices since 1985, there has been a perceptible shift in energy policy, leading to a renewed emphasis on supply-system expansion in the form of major projects using conventional energy sources, including fossil fuels. Within the framework of the ongoing restructuring of the global economy, countries of the Asian-Pacific region are seen to be emerging as

major forces to be reckoned with. Led by Japan, increasing numbers of countries have opted for a rapid industrialization of their economies. Countries with large agricultural sectors and rural populations like India and China have intensified the process of agricultural mechanization while making efforts to cope with rapid urbanization. The threat of global climatic changes would bring a new element to energy policy formulation. In the long run, it may well be possible to visualize a close and direct interaction between energy and environmental policy.

49432 (ANL/EAIS/TM–17, pp. 4.1-4.16) **The effects of a rapid global warming: Garden of eden or global impoverishment?.** Woodwell, G.M. (Woods Hole Research Center, MA (USA)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

The purpose of this paper is to offer an analysis of the causes of the warming trend, its effects, including the possibility that the warming will speed releases of additional carbon dioxide and methane from biotic sources, and to suggest steps to stop or slow the changes. The central point advanced here is that a global warming has important implications for the course of the warming itself. The evidence for the changes in the composition of the atmosphere is best for carbon dioxide. This record provides the most powerful data we have for interpreting the causes and implications of the accumulation of carbon dioxide in the atmosphere. The upward trend of the curve defines the rate of accumulation of carbon dioxide. Over the past 15 years the annual accumulation has been about 1.5 ppm, about 3 billion tons of C. The common assumption has been that the rate of increase reflects the use of fossil fuels globally, but deforestation and the accelerated decay of organic matter due to the drainage of wetlands have also contributed significantly. The curve contains inflections whose causes have not been well defined. The conspicuous seasonal oscillation shows a peak carbon dioxide concentration in late winter and a minimum in late summer. The periodicity is reversed in the southern hemisphere to conform to the southern seasons. The oscillation is important because it is caused by the metabolism of forests and is the integration of two curves, one for gross photosynthesis and the other for total respiration. The fact that the metabolism of forests can have such a large effect on the composition of the atmosphere in weeks emphasizes that the short-term control atmospheric composition lies with forests and not elsewhere. This observation is important because it challenges the assumption that the oceans play the dominant role in determining the composition of the atmosphere in the short term. 31 refs., 3 figs.

49433 (ANL/EAIS/TM–17, pp. 4.17-4.23) **Mitigating climate change: Strategies to finance retention of tropical forests.** Qureshi, A. (Climate Institute, Washington, DC (USA)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

During the 1980's six years have been recorded as the warmest since official records were kept. On the global average 1988 was the warmest year in more than a century. The world is experiencing heavy floods in some parts, droughts in others and heat increases in many places. Carbon dioxide (CO_2), methane (CH_4), oxides of nitrogen (NO_x), chlorofluorocarbons (CFC's) and other trace gases resulting from industrial energy and agricultural activities are implicated in global climate change. While use of fossil fuel is the main source of carbon release (5.2 gigatons annually) into the atmosphere, forest burning and tropical deforestation is the second largest source (over 1.8 gigatons annually). Over the past century or so, atmospheric CO_2 has risen 25% to about 350 ppm. If present trends continue, the increased CO_2 levels in the atmosphere could raise the Earth's temperature by 1.5 −4.5°C by the year 2050. 7 figs., 1 tab.

49434 (ANL/EAIS/TM–17, pp. 4.25-4.31) **Climate change and US water resources.** Burns, D.M. (American Association for the Advancement of Science, Washington, DC (USA)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

Characteristically, climate includes a large annual variability of temperature or precipitation around an average or mean, even if the mean is not changing. Changes are predicted when the effects of a doubled CO_2 content are felt. The doubling is expected in the middle of the 21st Century unless present burning of carbon in coal, petroleum and wood decreases. Less burning seems unlikely because we do not have other large sources of energy and because developing nations are bent on industrialization. Climate models tells us little about what will happen at any specific location. Even after a climatological prediction of temperature and precipitation are made, however, we still do not know whether water resources will meet our demands. This paper reviews the present resources and vulnerabilities and examines how evaporation is subtracted from present precipitation to leave runoff as water resources and how their variation is tempered by reservoirs and aquifers. The effects of CO_2 increase will be both positive and negative with precipitation decreasing in some places and increasing in others. Plants grow faster and will temper their transpiration of water. The review covers the effects on human activities of the changes in water resources. Usually the probabilities of extremes like flood or drought will change more than averages. In the West the effects of a change will be greatest simply because it is arid. Increased evaporation will have a larger relative effect on water resources in the arid places. Maintaining the present irrigated area in the West will be hard. In the East irrigated area is expected to increase several fold but still be small. Everywhere seasonality will change as snow melts earlier, freezing is less persistent and the abundant water floods rivers and fills reservoirs at new seasons.

49435 (ANL/EAIS/TM–17, pp. 4.33-4.57) **Coastal reforestation and agroforestry as immediate ameliorative measures to address global warming and to promote sustainable habitation of low-lying and coastal areas.** Thaman, R.R. (Univ. of the South Pacific, Suvia (Fiji)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

This paper stresses not only the need for coastal reforestation, but also the need for the promotion of coastal agroforestry (the planting and protection of trees and tree-like plants). This practice is central to the economic, cultural and ecological stability of all Pacific island societies. Classical deforestation, particularly the rapid destruction of extensive areas of tropical forests, which serve as a massive carbon sinks and sequester large amounts of CO_2 as part of the growing process, has received widespread attention. A process, perhaps just as important on many small islands, which have few if any non-coastal forest resources, is agrodeforestation in the forms of both declining tree planting and the elimination of trees from agricultural and urban landscapes. It is suggested that programmes of coastal reforestation, agroforestry, and agroforestry-based coastal reclamation, based primarily on indigenous, salt- and wind-resistant trees and plants could be the most direct, cost-effective, and self-help-oriented strategies. The resources and the technologies already exist. The balance of the paper will focus on: (1) a brief description of the potential impact of, and suggested measures to address global warming on the low-lying islands and coastal areas of the Pacific Ocean; (2) the nature and ecological and cultural importance of the plant resources available for coastal reforestation and agroforestry as a means of addressing the impacts of global warming and eustatic rises in sea level; (3) how coastal reforestation and agroforestry could address many of the commonly stated non-global-warming- related development goals in the Pacific islands; and (4) strategies for coastal reforestation that could be adopted immediately. 40 refs., 3 tabs.

49436 (ANL/EAIS/TM–17, pp. 4.59-4.63) **Report of working group B: Priorities for research in agriculture and forestry.**

Chiang, Shan-Hsin; Guang, Xia; Irving, P.; Kretschmer, G.; Snidvongs, K.; Soto, A.; Zhongping, Zhu. Argonne National Lab., IL (USA). [1989]. (CONF-8906244--: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

The paper presents the basic considerations and terms of reference for agriculture and forestry research priorities to identify: (1) scientific certainties and uncertainties, (2) physical impacts of global warming, (3) social impacts, and (4) needs of people who have to make decisions with regard to future issues. Global considerations and aspects are stressed.

49437 (ANL/EAIS/TM-17, pp. 5.1-5.12) **Sea-level rise: Assessing the scientific debate.** Jones, C.B. (Univ. of Hawaii, Manoa (USA)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244--: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

This paper summarizes the background of scientific issues and debates surrounding the climate change headlines. While the goal is to present a balanced, reflective portrait of those debates, the overall message sent to policy-makers and planners must still be the need to act now to plan for this emerging global crisis. In other words, while various interpretations exist as to whether the sea level is rising, it is abundantly clear to this author that policies and planning for action must be developed soon. It may be premature right now to assert that the sea level is beginning to rise due to human CO_2 (and other greenhouse gases) emissions, but the evidence strongly suggests that probability. That having been said, the next questions which arise are: if the sea level is going to rise, how much will it rise, and when? 25 refs.

49438 (ANL/EAIS/TM-17, pp. 5.13-5.39) **Global warming and rise in sea level in the south Asian seas region.** Quraishee, G.S. (National Institute of Oceanography, Karachi (Pakistan)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244--: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

There is a growing consensus that increased green house gases in the atmosphere has induced climatic changes. According to scientific evidence, the earth's atmosphere could warm by anywhere from 1.5 to 4.5 degrees centigrade by the middle of the next century and the rise in sea level could by between 20-140 cm by the end of the 21st century. The increase in number of hot days per year (> 35°C) is shown in Fig. 1. The increasing trend is also shown. If the present rate of emission continues and their respective values attainable by the middle of 21st century. The increase in Global models are being developed which can numerically simulate climate on the time scale of decades to a century. Some of these models give alarming results warranting immediate action to be taken to mitigate predicted impacts. But the worlds climate is so complex that models oversimplified them. Climatic changes had occurred in the geologic past of the order of decades to centuries. Understanding the rapidity, magnitude and distribution of such events will provide guidance to assess the likelihood and implications of such oscillations in the future. The anthropogenic change in climate appears to be abrupt and large. It may also be noted that the climatic system is known to have large inertia, once such changes are begun they will be difficult to revise. The IOC and UNEP established a Task Team to assess impact of climatic changes and rise in sea level due to green house warming in the South Asian Seas (SAS) Region. UNEP provided the terms of reference which was the same for all the regional studies so as to ensure the same framework for the SAS Region and make comparison possible. This paper is based on the views of some of the experts for the SAS Region while incorporating the recent developments particularly implication on energy, socio-economics, monitoring strategy, and future course of actions. 12 refs., 5 figs., 1 tab.

49439 (ANL/EAIS/TM-17, pp. 5.109-5.119) **Coping with sea level rise.** Morgan, J.R. (Environment and Policy Institute, Honolulu, HI (USA)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244--: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

Although there is a degree of controversy over the well advertised Greenhouse Affect and its influence on sea levels, it is reasonable to assume that the earth is in a current warming trend. Whether atmospheric warming is a consequence of so-called natural factors, which have occurred periodically in the past and can be expected in the future, or is a result of the activities of man, particularly his contribution to the production of greenhouse gases, is not crucial to the main thesis of this paper. Man must somehow cope with rising sea levels, and government policies should consider the probability that coastal land will be menaced by the sea over the next 50 to 100 years. Atmospheric warming will cause melting of glacial ice, the greatest quantities of which are contained in the Antarctic ice sheet and ice shelves. The resultant temperature increase in the oceans will result in an expansion of sea water and a reduction in its density. Both glacial melting and thermal expansion of seawater will cause sea level to rise worldwide. However, certain geographic areas will be affected more than others, and in some regions where isostatic rebound is occurring, eustatic sea level rise will be masked by the rising of the land. The importance of sea level rise in specific geographic areas depends not only on the very general factors noted above, but on smaller scale features of the landscape, such as near shore and coastal topography, settlement patterns, population densities, and land use. Hence, strategies for coping with sea level rise differ for different countries and even for different coastal regions within a country. 2 refs., 1 tab.

49440 (ANL/EAIS/TM-17, pp. 5.121-5.128) **Report of working group A: Priorities for research in sea-level rise.** Gustafson, P.; Huq, S.; Jones, C.; Morgan, J. Argonne National Lab., IL (USA). [1989]. (CONF-8906244--: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

The paper presents the basic considerations and terms of reference for research priorities in sea-level rise to identify: (1) scientific certainties and uncertainties, (2) physical impacts of global warming, (3) social impacts, and (4) needs of people who have to make decisions with regard to future issues. Global considerations and aspects are stressed. Continued research is recommended in two areas: (1) Sea-level and tectonic movement need to be monitored and then mapped out in a form accessible to policy makers. (2) Accelerated research is needed on the causes and nature of climate change, including: thermal expansion of oceans, storm frequency and type, effect of changed biological activity, and island loss and building effects in extreme events. This information needs to be agreed upon by scientists and presented clearly and simply to policy makers with a caveat as to the level of uncertainty involved in the consensus. 2 tabs.

49441 (ANL/EAIS/TM-17, pp. 5.41-5.62) **Global climate change and coastal zone management in Bangladesh: Issues and options.** Asaduzzaman, M. (Bangladesh Institute of Development Studies, Dhaka (Bangladesh)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244--: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

The coastal zone plays a very important role in the economy of Bangladesh, mo re particularly because of existence and exploitation of environmentally determined resources like shrimp and the mangrove forest. The dynamic nature of the environment of the coastal zone makes its proper management a quite difficult task. GW and the consequent SLR will make it increasingly more difficult because of the multifaceted nature of their impact. The specific

problems that would arise in the wake of GW and SLR are inundation of very large areas, displacement of a very large population, loss of agricultural and shrimp land, the vanishing of the mangroves, closure of industries and relocation of others and of course gigantic loss of income and employment of the people of coastal areas. Increased salinity will also aggravate existing problems of fresh water supply and of biomass supply. The response to GW and SLR will have to be at global, regional and national levels while various operational activities may have to be initiated at and around the coastal zone. At the national level these will include research and monitoring on coastal dynamics (SLR and land subsidence), an effective population control policy, emphasis on forestry, particularly social forestry, renewable energy and energy conservation. Specific coastal level activities may include large scale coastal embankment rehabilitation and construction, evolution of salt-resistant paddy and other crops and search for cropping systems adapted to an increasingly saline environment, adaptation of present shrimp land to the new situation, development of coastal fisheries through credit programmes, replacement of Heritiera fomes with more salt-resistant Heritiera in the Sundarban, research on the mangrove ecosystem, studies on ways of industrial relocation and evolution of new inexpensive house building techniques for the coastal areas under threat. 11 refs., 3 tabs.

49442 (ANL/EAIS/TM–17, pp. 5.63-5.107) **Effects of global warming on South Pacific islands, 1900-2100.** Nunn, P.D. (Univ. of the South Pacific, Suva (Fiji)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

Knowledge about past and present South Pacific island environments varies considerably in both detail and calibre depending on numerous factors including location (for example, proximity to main centres) and resource potential. Such imbalances hinder the production of meaningful (locally applicable) accounts of recent environmental changes for the region and reduce the credibility of region-specific predictions concerning future changes. For example, no tide-gauge records extending back more than thirty years exist for South Pacific islands so direct (data-equivalent) comparison with secular changes of sea level recorded elsewhere is not possible. Similarly, region-specific predictions of future sea-level rise commonly depend on high-calibre local information which is not yet available for the South Pacific region although a series of modern gauges was promised to the region by Australia at the 1988 South Pacific Forum meeting. Interpolation between control points across the South Pacific provides an unsatisfactory basis for short-term predictions compared to that used elsewhere. This paper assesses the evidence for environmental changes in the South Pacific since 1900 which are attributable to contemporary global warming then goes on to evaluate the future impacts of continued warming on a series of typical islands and selected urban centres in the region. 42 refs., 4 figs., 3 tabs.

49443 (ANL/EAIS/TM–17, pp. 6.1-6.9) **Global warming: Perspectives on India's energy policies and responses to climate change.** Pachauri, R.K. (Tata Energy Research Institute, New Delhi (India)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

India emerged from colonial rule in 1947 after a prolonged period of economic stagnation. It was faced with the general challenge of restructuring its economic system towards greater self-reliance with a move away from exports of primary commodities and a continuing import of manufactured goods. The major share of responsibility for global warming lies with the developed countries, and major efforts will have to be made first by these nations before sacrifices are demanded from the world's poor and under-privileged. For instance, cumulative contribution of carbon dioxide by different regions of the world indicates that the overwhelming responsibility for reduction of carbon dioxide emissions lies essentially with the developed nations of the west. The arguments for some severe curbs on growth of fossil fuel consumption in the developing countries is examined in this paper in the context of the Indian example. India is the world's largest democracy and has registered steady growth over the 42 years of its independent existence but poverty still affects several hundred million people. The co-existence of this reality with modern developments and advancement makes analysis of contemporary Indian policies complex and difficult, inhibiting generalizations and aggregation of facts. Some current features of Indian development provide a backdrop to energy policies and response strategies for climate change. India's per capita income is around U.S. $300 with sharp disparities between rich and poor. There is a growing middle-class in the country estimated between 100-160 million people, who have attained levels of economic well-being in keeping with at least the less affluent nations of Europe. Even though this is a large segment of people, it is a small fraction of India's 800 million population, with 25 per cent located in urban areas and the balance living off the land in rural areas. 3 refs., 1 fig., 3 tabs.

49444 (ANL/EAIS/TM–17, pp. 6.11-6.29) **The Japanese response to global warming - background, policy and research work.** Nishioka, Shuzo (National Institute for Environmental Studies, Tsukuba, Ibaraki (Japan)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

Japan holds 14% of the world's GNP through its economic activities, occupies 0.27% of land area and has 2.5% of the world's population. This means that it has a deep dependency on foreign countries and the world ecosystem to supply its living needs. This is especially true for agricultural products, where Japan can only provide 30% of its food needs on original calorific basis. It imports almost all the wheat, bean and maize it uses from USA, Canada and Australia. Half of the lumber it consumes is imported from Malaysia, USA, USSR and Canada. Japan's fish catch from the world's oceans amounts to 14% of the world total. The other chief imported materials, consist mainly of primary products such as cotton, wool, natural gum, sugar etc., such primary industrial products come from developing countries, who are strongly dependent upon climatic conditions. Japan is only self sufficient in 20% of its energy demand. It has a small domestic resource of low quality coal (2.3% of total energy), hydraulic power (4.1%) and nuclear power (10%). So this deficiency in domestic resources and dependency upon the world's ecosystem means that Japan has to maintain a population of 120 million and makes contribution to the world's economy through its industrial technology and services. Climatic change is certainly a challenge to all of the human race in this interdependent world, but it is taken more seriously by countries with scarce resources such as Japan, than ones with abundant resources which they can control. This paper discusses Japan's: (1) impacts of global warming, (2) energy position, (3) contribution to global warming, and (4) technological progress within Environmental and Energy fields. 5 refs., 8 tabs.

49445 (ANL/EAIS/TM–17, pp. 6.117-6.122) **Malaysia's response to global climate change.** Yueh Chuen Ho, P. (Ministry of Science, Technology and Environment, Kuala Lumpur (Malaysia)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

Concern in Malaysia over global climate change has, over the last 2-3 years, been given greater attention as evidence from various studies confirmed the threat to the global environment due to effect of various greenhouse gases. Evidence presented by various national and international organizations obtained through systematic monitoring and research, and presented at various forums have been the catalyst for creating awareness of the problem. Concern on the subject has increasingly become a topic of discussion not only among scientists and environmentalists but also among the public. This awareness has no doubt been created

through the media including local and foreign newspapers and magazines, local radio and television, non-governmental group forums as well as the education efforts of the Department of Environment. This year, the Department of Environment, in conjunction with World Environment Day, is organizing an exhibition on the theme which was adopted by the United Nations Environment Programme, entitled Global Warming: Global Warning.

49446 (ANL/EAIS/TM–17, pp. 6.123-6.138) **Combatting the greenhouse effect: Philippine style.** Labanan-Garcia, L.G. (National Power Corp., Diliman, Quezon City (Philippines)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

The greenhouse effect is currently considered as the most pressing and complex environmental problem in the world. With the onset of the industrial age, man's activities have increased the quantity of the greenhouse gases such as carbon dioxide, methane, nitrous oxide, ozone and chlorofluorocarbons near the surface of the earth. Thus, when the sun's heat penetrates the atmosphere, these greenhouse gases help to retain some of the warmth that would otherwise be reflected back into space, thereby warming it up. Scientists initially blame the greenhouse phenomenon to all forms of combustion which produce carbon dioxide. But further studies showed that on a molecule for molecule basis, methane, nitrous oxide, ozone and chlorofluorocarbons (CFCs) are likely to produce worse effects than carbon dioxide. It has been calculated that one molecule of CFC is likely to have a similar effect on the climate as 10,000 molecules of carbon dioxide. This paper will discuss-the measures being adopted by the Philippines to combat the greenhouse effect beginning with a discussion of the government units in the Philippines responsible in the protection of the environment, the rules and regulations governing environmental conditions including the penalties imposed for non-compliance of these rules and future legislations concerning environmental protection. A separate section is devoted to the five-year energy plan as well as the mitigating measures being implemented by the National Power Corporation, the Philippines' bulk power supplier for the protection of the ecological balance. The final section discusses policy recommendations affecting plant operations and other areas for improvement in order to minimize if not completely eradicate the greenhouse effect. 18 refs.

49447 (ANL/EAIS/TM–17, pp. 6.139-6.144) **Energy consumption and generation of greenhouse gases in Hong Kong.** Chung, F.M.K. (Hong Kong Government, Wan Chai (Hong Kong)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

This paper gives a brief account of the use of fossil fuels in Hong Kong in the past decade, and explores the various possible options for reducing the emission of greenhouse gases in the Hong Kong situation. The total energy consumption has increased from 251 million GJ in 1979 to 427 million GJ in 1987, an increase of about 70% in 10 years. The main types of fuel in use are coal, gasoline, kerosene, diesel, fuel oil, and LPG. The use of fuel oil has dropped from 3,898 kilo tonnes in 1979 to 1,866 kilo tonnes in 1987. On the other hand, the use of coal has increased from 32 kilo tonnes in 1979 to 8,031 kilo tonnes in 1987. The significant switch from fuel oil to coal is caused by the installation of 2 coal fired power stations, one station 1800MW and another 4400 MW. The use of other types of fossil fuels has recorded only a steady increase. Fig. 1 shows the Hong Kong's consumption of the various fuels in the period 1979 - 87. Fig. 2 shows the energy consumption trend in the decade. Based on the types of fossil fuels used, the CO_2 emission is calculated. The results are shown in Fig. 3. It can be seen that although the total energy consumption has increased by 70% in 10 years, the CO_2 emission has increased from 17 million tonnes in 1979 to 38 million tonnes in 1987, an increase of 120%. This is due to the fact that coal produces more CO_2 than fuel oil for the same unit of energy output. The use of other types of fossil fuel has increased steadily during the past 10 years. 3 figs.

49448 (ANL/EAIS/TM–17, pp. 6.31-6.36) **China's perspective: impact of greenhouse warming and response strategies.** Qu, Geping (National Environmental Protection Agency, Beijing (China)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

Global Warming has become an issue of great concern and focus of discussions among scientists and the general public the world over in recent years. It is the theme of this year's World Environment Day, which is not accidental. Environmental problems such as greenhouse effect and the depletion of ozone layer have become a major potential threat to the existence and development of the mankind on the earth. This has awakened people and they have become to understand that strategies must be sought and common efforts must be made to deal with these problems. Facing global warming,what environmental changes will take place in China? What impact will it exert on the economic development and the people's livelihood? What strategies will China take? These are questions the general public of China and all these who are interested in global environmental problems are concerned about. In the last hundred years, the global climate has experienced a tendency of gradual warming. The general tendency of climate change in China basically corresponded with that of the world. In the future the surface temperate of China will tend to rise under continuous fluctuations. Climate change will exert a profound impact on China's economic development. China is a major energy consuming power that understands its duty in adjusting energy strategies and in controlling the greenhouse effect. The high volume of dirty energy source coal consumed and a low energy efficiency factor are two major problems for China. Some actions being pursued by China are discussed. 2 tabs.

49449 (ANL/EAIS/TM–17, pp. 6.37-6.52) **Global warming: Australian impacts and responses.** Kretschmer, G. (Dept. of the Arts, Sport, the Environment, Tourism, and Territories, Canberra, New South Wales (Australia)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244–: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

The prospect of global warming as a consequence of increasing concentrations of greenhouse gases in the atmosphere is a matter of the highest concern for Australia. It shares its concerns with all other countries of the world but is potentially placed in a situation of particular vulnerability because of the combination of: (1) its economic dependence on agriculture and fossil fuel exports; (2) the expectation that large areas of its agriculturally productive land will be subject to hotter and drier conditions; (3) the extent of its coastline (over 36,000 km in length) and the concentration of its major population centres along it; (4) the likely extension of cyclones and other extreme climatic events into previously unaffected highly populated and unprepared areas of the country; (5) the extension of the area of the country where tropical diseases - human and animal - are likely to occur; and (6) the potential shrinking of habitat for unique flora and fauna. Australia is therefore affording the highest priority to responding to the threat of global warming through a three-phase strategy of: (1) further research, particularly to provide regional assessments of likely climate changes and their impacts; (2) development of policies to reduce the build-up of greenhouse gases in the atmosphere so as to reduce the greenhouse effect; and (3) development of policies to deal with the effects of climate change due to the greenhouse effect, by means of minimizing the impact of such changes or adapting to those impacts. This paper discusses the contemporary state of knowledge of the likely impacts of global warming on Australia and recent Government initiatives to address the greenhouse threat. 12 refs.

49450 (ANL/EAIS/TM–17, pp. 6.53-6.68) **New Zealand's response to global climate change.** Lawrence, J. (Ministry for the

Environment, Wellington (New Zealand)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244--: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

New Zealand is actively involved in policy development work on global climate change. New Zealand has actively participated at Ministerial and official levels in the Hague Declaration and the work of the WMO/UNEP Intergovernmental Panel on Climate Change and co chairs with the Netherlands the Coastal Zone Subgroup of the Response Strategies Working Group. New Zealand supports a global convention on climate and institutional means of control through the International Court of Justice, New Zealand supports the existing UN agencies as the means of implementation and a strong Pacific input to the policy development work. The New Zealand Government initiated a three-phase Climate Change Programme in June 1988. The Facts Working Group has prepared climate change scenarios for New Zealand and the Impacts Working Group is currently receiving expert responses to the scenarios in terms of the biophysical environment. In July the social and economic impacts will be assessed and an integrated impacts assessment developed by March 1990. The Policy Working Group is currently identifying key issues on which the impacts work can focus. CO_2 and other greenhouse gas emissions are being studied for New Zealand which it appears is a net consumer of CO_2. Energy management issues will dominate in this context. The Policy Group report by June 1990. The hallmark of the NZ Climate Change Programme is a consultative process with expert and community representatives.

49451 (ANL/EAIS/TM--17, pp. 6.69-6.79) **Korea's energy policy and its environmental implications.** Byong-Hun, Ahn (Korea Advanced Institute of Science, Seoul (Korea)). Argonne National Lab., IL (USA). [1989]. (CONF-8906244--: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

This paper discusses the evolution of Korea's energy policy from the environmental perspective. Also discussed are the emerging interests of Korea's policy and research communities in the interactions between the global environment and the energy use, along with ongoing debate on what should be Korea's appropriate strategic response to worldwide greenhouse gas (GHG) reduction efforts. Korea has take de-oiling as a major energy policy. Korea has enjoyed rapid economic growth. Korea's energy system has introduced substantial amounts of nuclear power and imported bituminous coal as substitutes for oil. Rigid energy policies have been replaced with flexible approaches. 3 figs., 5 tabs.

49452 (ANL/EAIS/TM--17, pp. 6.81-6.98) **Reversing the atmospheric temperature warming in Taiwan.** Shan-Hsin, Chiang (National Taiwan Univ. (China)); Ming-Chin, Wu; Andres, L. Argonne National Lab., IL (USA). [1989]. (CONF-8906244--: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

For the past 90 years, mean annual temperature increase of about 0.8°C has been observed in a few big cities in Taiwan. Temperature increase would lead to thermal expansion of the oceans and the melting of the Antarctic and Arctic ice sheets. Sea levels would rise, inundating low-lying land areas that include many of the rice fields, fish ponds, and shrimp ponds. Because of the sea level rise, coupled with land subsidence caused by fast groundwater withdrawal rate, the western portion of Taiwan is regarded as the sinking coastal region. For the last 80 years, the Peikang Stream delta (a west-bound river system) has been receding at an average rate of over 49.9 m a year. With about 20 million people living on Taiwan island covering only 36,000 km^2 the government is committed to concentrate efforts in slowing down the greenhouse effects and reversing the temperature warming trend. This includes better air pollution controls, protecting current forest resources, promoting reforestation, restricting groundwater use, regulating coastal fish farming, and strengthening environmental education to rouse public awareness. 12 refs., 7 figs., 4 tabs.

49453 (ANL/EAIS/TM--17, pp. 6.99-6.116) **Global warming and Bangladesh: implications and responses.** Huq, S. (Bangladesh Centre for Advanced Studies, Dhaka (Bangladesh)); Rahman, A.A. Argonne National Lab., IL (USA). [1989]. (CONF-8906244--: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

The implications of global warming for Bangladesh including sea level rise, increased frequency of floods and cyclones and other changes in weather patterns are considered along with possible responses and actions that may be taken. The possibility of global climate change, particularly global warming due to the so called Greenhouse Effect has increasingly been raising attention recently both amongst scientists and the general public. Bangladesh is one of the countries which is likely to be most critically and adversely affected by the consequences of such a global warming and subsequent sea level rise which will affect the low lying coastal areas as has been pointed out by a number of authors (Milliman et al, 1987, Broadus, 1987, and Brammer 1989, Rahman and Huq 1989). However, the consequences for Bangladesh are likely to be far more complex and will require a much better understanding of the complexities of each sub ecosystem in order to make reasonably accurate predictions and plan appropriate responses. Some of the possible impacts, the areas for further research and the responses being undertaken are described. 10 refs., 7 figs., 1 tab.

49454 (ANL/EAIS/TM--17, pp. 7.1-7.21) **Responding to the threat of global warming: Options for the Pacific and Asia.** Streets, D.G.; Bhatti, N.; Siddiqi, T.A. Argonne National Lab., IL (USA). [1989]. (CONF-8906244--: Responding to the threat of global warming: options for the Pacific and Asia, Honolulu, HI (USA), 21-27 Jun 1989). In *Responding to the threat of global warming: Options for the Pacific and Asia.* Order Number DE90014756. Source: NTIS, PC A23/MF A01.

Global climate change has been transformed from an esoteric topic of interest mainly to scientists to one of worldwide concern to policymakers, the business communities, the media, and the general public. A number of high-level international meetings dealing with this issue have been held in the past two years. With growing recognition that the global climate change phenomenon would result in different regional (and local) effects, a workshop was organized by Argonne National Laboratory and the East-West Center to assess the likely consequences of this threat and the possible remediation options available to the countries of the Pacific and Asia. This paper summarizes the deliberations and conclusions of the workshop, which was held at the East-West Center in Honolulu, Hawaii, from June 21-27, 1989. It has become evident that elevated concentrations of certain gases in the atmosphere have the potential to significantly alter the climate of the earth. The most important of these gases (called greenhouse gases) from a global climate-altering standpoint is carbon dioxide (CO_2). Chlorofluorocarbons, methane, and nitrous oxide also contribute significantly. Greenhouse gases absorb some of the radiation released from the earth's surface and re-radiate it back to the earth, thereby resulting in warming of the lower atmosphere. Carbon dioxide is produced by natural sources (ocean and land releases) as well as by anthropogenic activities such as the combustion of fossil fuels and land use changes, particularly deforestation. Man-made activities contributing to total atmospheric CO_2 levels has increased from 270-290 ppm in the mid-1800s to 345-350ppm today. Carbon dioxide concentrations are expected to be twice the 1850 value by the middle of the next century. Doubling of CO_2 levels (and increase in other greenhouse gases) would yield a temperature rise of 1.5-4.5°C. 35 refs., 4 figs.

49455 (ARC--90-02879) **Towards a strategy for adapting to climate change in Alberta.** Wong, R.K.W.; English, M.; Barlow, F.D.; Cheng, L.; Tremaine, K.R. Alberta Research Council, Edmonton, AB (Canada). 1989. 87p. (MICROLOG--90-02879). Source: PC Alberta Legislature Library, 216 Legislature Bldg., Edmonton,

AB, CAN T5K 2B6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The potential impact of a global climate change due to the greenhouse effect, coupled with recent drought conditions and weather anomalies in Alberta, led to a preliminary assessment of these global effects on Alberta's climate. This assessment was addressed in terms of three tasks: analysis of climate records; assessment of general circulation models' (GMC) results; and identification of the strategic requirements of the participating agencies for adapting to possible climate change in Alberta. GCM results do not reproduce Alberta's normal climate well. There are greater discrepancies in the precipitation estimates than in the temperature estimates. Climate records indicate an increase of 0.2 to 1.4°C in the average annual temperature of Alberta between 1981 and 1987 over the period between 1951 and 1980. Also a decrease in the mean monthly temperature range from 0.8 to more than 2.0°C was detected, suggesting a decrease in the occurrence of temperature extremes. GMC simulations of climate under a doubling of atmospheric carbon dioxide suggest an increase of 3 to 7°C in annual temperature and a 7 to 30% increase in precipitation. This situation is expected to be reached by the years 2030 to 2050. The increase in temperature will result in a change in the water balance at the earth's surface irrespective of any change in precipitation. The important conclusions from the user needs survey regarding the effects of climate change is that there is a lack of confidence in the climate model results. 76 refs., 66 figs., 21 tabs.

49456 (CONF-900534–4) **Modeled sulfur deposition trends since 1990 in North America.** Shannon, J.D. Argonne National Lab., IL (USA). [1990]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 18. NATO/CCMS international technical meeting on air pollution modelling and its applications; Vancouver (Canada); 13-17 May 1990. Order Number DE90017676. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Inventories of historical emissions of acidic deposition precursors in the US have been assembled. One might expect that such data would be widely applied in studies of possible long-term effects associated with acid deposition, such as lake acidification or forest damage. Use of the inventories in such investigations, however, has been surprisingly limited. This may be because atmospheric deposition rather than precursor emissions is the direct input to ecological systems. Although some researchers have used emission trends as surrogates for deposition trends, the relationships between aggregated emissions and resulting patterns of atmospheric concentrations or deposition have changed over the years as the seasonal, horizontal, and vertical distributions of emissions have changed. In the hope of providing additional information useful to researchers investigating deposition effects, we have simulated wet and dry S deposition and atmospheric concentrations of SO_2 and sulfate over the United States and Canada since 1900 with the ASTRAP model. Source-receptor matrices aggregated to the state or province level have been calculated as well. Simulations are seasonal, at five-year intervals from 1900 through 1960 and at one-year intervals from 1960 through 1985. 8 refs., 5 figs.

49457 (CONF-900676–14) **Summary of the NAPAP state of science report on deposition monitoring in North America, 1979–1987.** Sisterson, D.L. (Argonne National Lab., IL (USA)); Bowersox, V.C.; Meyers, T.P.; Olsen, A.R.; Vong, R.J. Argonne National Lab., IL (USA). [1990]. 16p. Sponsored by U.S. Department of the Interior. DOE Contract W-31109-ENG-38. From 83. annual meeting and exhibition of the Air and Waste Management Association; Pittsburgh, PA (USA); 24-29 Jun 1990. Order Number DE90017675. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report summarizes the results of a much larger document that discusses methods to monitor wet, dry, and droplet deposition in the United States and Canada and provides temporal and spatial analyses. The introduction here gives the scope of the larger document, while the body of this report summarizes the important findings of wet, dry, and droplet deposition of the larger document. The main purpose of the larger document is to identify the locations of maximum deposition of pollutants and to determine if the spatial and temporal patterns have changed substantially during the period 1979 to 1987. A significant portion of the document addresses the representativeness and completeness of large-scale network deposition data at regional and local scales. 23 refs., 2 figs., 2 tabs.

49458 (DOE/ER/60954–1) **Atmospheric processes over complex terrain: Volume 23, No. 45.** Meterological Monographs. Blumen, W. (Colorado Univ., Boulder, CO (USA)). American Meteorological Society, Boston, MA (USA). Jun 1990. 323p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-90ER60954. (CONF-8810430–: Workshop on current direction in atmospheric processes over complex terrain, Park City, UT (USA), 24-28 Oct 1988). Order Number DE90017458. Source: NTIS, PC A15/MF A01 - OSTI; GPO Dep.

A workshop on atmospheric processes over complex terrain, sponsored by the American Meteorological Society, was convened in Park City, Utah from 24–28 October 1988. The overall objective of the workshop was one of interaction and synthesis–interaction among atmospheric scientists carrying out research on a variety of orographic flow problems, and a synthesis of their results and points of view into an assessment of the current status of topical research problems. The final day of the workshop was devoted to an open discussion on the research directions that could be anticipated in the next decade because of new and planned instrumentation and observational networks, the recent emphasis on development of mesoscale numerical models, and continual theoretical investigations of thermally forced flows, orographic waves, and stratified turbulence. This monograph represents an outgrowth of the Park City Workshop. The authors have contributed chapters based on their lecture material. Workshop discussions indicated interest in both the remote sensing and predictability of orographic flows. These chapters were solicited following the workshop in order to provide a more balanced view of current progress and future directions in research on atmospheric processes over complex terrain.

49459 (GSF-HY–38/88, pp. 21-28) **Investigations on the diffusion of inorganic pollutants in selected sediments from the Asse cap rock and in clay samples from the Niederwallach landfill.** Wolfrum, C.; Lang, H. Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Hydrologie. Oct 1989. (In German). In *Annual report 1988 of the GSF Institute of Hydrology.* Order Number DE90519861. Source: NTIS (US Sales Only), PC A12/MF A01.

Diffusion coefficients were determined for Se-75, Sr-85, Zr-95/Nb under aerobic, and for Tc-99 both under aerobic and non-aerobic test conditions, in undisturbed samples from drilling cores from the cap rock of the Asse mine. The remaining test programme had the purpose of verifying the impermeability of clays to gypsum from flue gas desulfurization plant. Samples consisted of the filling material for the Niederwallach landfill. The diffusion coefficient was measured for S-35 (Na_2SO_4). (DG).

49460 (GSF-HY–38/88, pp. 158-162) **Krypton-85 concentration in the atmosphere.** Held, J.; Rauert, W. Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Hydrologie. Oct 1989. (In German). In *Annual report 1988 of the GSF Institute of Hydrology.* Order Number DE90519861. Source: NTIS (US Sales Only), PC A12/MF A01.

Air samples collected half-monthly at Hof, at the Mappenberg near Wackersdorf, and at Neuherberg were continuously enriched, and the krypton-85 activity per m^3 air was determined. Conspicuously increased krypton-85 concentrations occurred in the second half of April of 1988. In comparison with this, the annual curve for tritium concentrations of precipitation samples collected monthly at Mappenberg was also established. Only a small proportion of the tritium stems from nuclear installations. (DG).

49461 (LBL–26455, pp. 152) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

It has been found that HSO_5^- reacts with HSO_3^- to produce disulfate ion, $S_2O_7^-$. Earlier work had shown that an intermediate with a lifetime of about one minute was formed in the $HSO_3^- - O_2$ reaction, and subsequently Chang, Littlejohn, and Hu identified it as $S_2O_7^{2-}$. A puzzling inconsistency remains, however: Chang et al. find that all of the HSO_3^- goes through $S_2O_7^{2-}$ whereas the

authors work consistently shows only half of it forming $S_2O_7^{2-}$ before forming sulfate ion. In the computer simulation of the exchange of solvent from the first coordination sphere of a metal ion, release of a constrained solvent particle at different distances from the metal ion results in three types of activated complex. They can be crudely characterized by the geometry of the five remaining, closely coordinated particles as (1) tetragonal pyramid, (2) trigonal bipyramide, and (3) a nonsymmetric trigonal bipyramid in which the three common basal particles project at angles of 90°, 135°, and 135° relative to each other. All computations are for a radius ratio of metal to solvent that permits six particles to just contact the metal ion and each other. More extensive runs will be made to identify the dominant reaction path.

49462 (LBL–26455, pp. 115-116) **Use of excess carbon-14 data to test 2D stratospheric models.** Johnston, H.S. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The excess carbon-14 data following the nuclear bomb tests of 1961-1962 have been organized in a form convenient to use for testing 2D models with respect to air transport in the middle to lower stratosphere. Detailed initial values for October 1963 are listed in tables, and extensive target values (observations made at specified altitudes) for the models to calculate are given at four latitudes, for each of four seasons, and for 2.75 years. This method uses observed carbon-14 profiles as initial values, instead of a model for the rise of the bomb debris.

49463 (LTKK-EN–C48) **Calculation of transport and radiation properties of flue gases.** Talonpoika, T. Lappeenrannan Teknillinen Korkeakoulu (Finland). Energiatekniikan Laitos. 1989. 48p. (In Finnish). Source: Lapperannan Teknillinen Korkeakoulu, Finland, Energratekniiken Laitos.

This paper includes the most important equations needed in the calculation of ideal gas mixtures. Equations for the calculation of thermal conductivity and dynamic viscosity of ideal gas mixtures are presented. These do not follow the same simple rules of weighting with mass or mole fractions as specific and molar quantities do. The emissivity of water vapour and carbon dioxide is presented as functions. Using the functions makes it easy to program the radiation properties of gas for a computer or a calculator. Carbon dioxide is calculated using a model of a mixture of six grey gases. Water vapour is calculated in two regions using a model of a mixture of four grey gases or one grey gas. The functions are valid for carbon dioxide in temperatures from 300 to 1800 K and in the product of partial pressure and path length from 0.01 to 10 m bar, and for water vapour from 300 to 1500 K and from 0.01 to 2 m bar. Equations have been developed so that simple and quick matrix calculation methods can be used. The notation of functions from different sources have been made uniform. This paper is primarily meant to be a teaching material. Therefore the derivations of equations are presented in a clear way and concrete examples of all functions are presented.

49464 (MIC–90-03198/XAB) **Indoor air quality in New Brunswick homes: Radon and radon daughters.** Radiation Protection Service, Fredericton, NB (Canada). ©1989. 18p. Source: NTIS, PC EE07/MF E01.

Text in English and French (Bilingual).

This booklet describes the nature and effects of radon in homes, as well as methods of measurement and control.

49465 (MIC–90-03274/XAB) **Members committee report: Critical point one.** Acid Deposition Research Program, Calgary, AB (Canada). ©1989. 46p. Source: NTISMF E01.

Microfiche only.

The program was initiated in 1984 to carry out research on the effects of acidifying compounds in the environment. This publication reviews the objectives for the medical diagnostic review, the occupational health feasibility study and the biophysical research program. The biophysical research program consisted of continuous air monitoring for oxides of sulphur and oxides of nitrogen from sites on Fortress Mountain and in Crossfield. The medical diagnostic review carried out a health survey of the residents of Pincher Creek in the vicinity of the sour gas plant and compared it to a control group. The occupational health feasibility study conducted a study of the effects of acid deposition on workers.

49466 (MIC–90-03532/XAB) **Measurement of biogenic and anthropogenic volatile organic compounds during the Canadian atmospheric chemistry study, July 17 to August 31, 1988.** Handy, B. Ontario Hydro, Toronto, ON (Canada). Research Div. ©1989. 170p. Source: NTIS, PC EE12/MF E01.

Description of a technique developed to measure biogenic (natural) and anthropogenic (man-made) volatile organic compounds (VOCs) present in ambient air. To advance understanding of the role of NOx vs VOCs and biogenic vs anthropogenic emissions in controlling ozone and other oxidant concentrations in Ontario, an intensive field study was undertaken during the summer of 1988. The study included making an intensive set of measurements of VOCs at Dorset and Egbert in rural south-central Ontario over 40 days. This report describes the results of that work.

49467 (MIC–90-03742/XAB) **Technical committee for the long-range transport of atmospheric pollutants in western and northern Canada: Annual report, 1987.** KML Co., Munich (Germany, F.R.). ©1988. 48p. Source: NTIS, PC EE07/MF E01.

In December 1982, the Committee, containing representatives from the federal government and the environment ministries of B.C., Alberta, Saskatchewan, Manitoba, and the Northwest Territories, launched a research program to identify current conditions in western Canada and provide the information necessary to develop management strategies. This annual report gives a history, current status and future activities of the Committee as a whole, then presents details of the programs of each of the governments in emission and control technology, air quality and deposition, surface water, soils and geology, vegetation and health. Jointly managed activities and industry and institutional activities are also detailed, along with tables of the annual deposition of wet sulphate at sampling stations in Western Canada. A glossary is included, as well as with the priorities for coordinated research and monitoring from 1985-88.

49468 (NEDO-P–8919) **Survey on solidification and utilization technology of CO_2.** New Energy Development Organization, Tokyo (Japan). Mar 1990. 173p. (In Japanese). Order Number DE91701465. Source: NTIS (US Sales Only), PC A08/MF A01.

A survey on solidification and utilization technology of CO_2 was conducted, promising technologies were selected and their realization was forecasted. Then, the contribution to the CO_2 issue and future development subjects were investigated. There are two main method for solidification. One is biological, and the other is chemical solidification. It is necessary for chemical solidification to separate as large volumes of high-density CO_2 as possible which is emitted, for example in a thermal power plant of large scale. Separation by membrane is competent for rough separation of CO_2, and can be followed by absorption or adsorption in the secondary concentration. In biological solidification which is used for low-density CO_2 in the atmosphere, a process of protein production from micro-algae is considered to be used in a large scale solidification. However for that, it is indispensable to come up with highly productive microalagae and make further development in production processes and systems. Meanwhile, there is on-going research for the catalytic hydrogenation of CO_2, which is offering possibility for practical use in the near future. This technology is considered to be the most promising one, as it will see a big demand in the form of fuel for automobiles as a substitute for petroleum. 161 refs., 28 figs., 20 tabs.

49469 (NEDO-P–8936) **Survey for impacts of global environmental issues on utilizations of alternative energies for oil.** New Energy Development Organization, Tokyo (Japan). Mar 1990. 292p. (In Japanese). Order Number DE91701464. Source: NTIS (US Sales Only), PC A13/MF A01.

An analysis on the factors related to carbon dioxide (CO_2) emissions in the past, was conducted. Then, an option menu of measures to prevent global warming including alternative energy-related ones, was discussed. In the industrial world, great contribution to increasing CO_2 emissions made by the economic growth factor has been offset by CO_2 reductions resulting from energy conservation and fuel switching. The Soviet/East European

and the developing worlds register increasing CO_2 emissions. Different countries have different views of the key option to be taken in limiting CO_2 emissions. Each of currently available CO_2 reduction measures has its own difficulties, and none of them is able to provide a powerful means to solve global warming problems single-handedly. To begin with, it is essential to produce time to find truly effective limiting and/or adapting measures by slowing global warming as much as possible through comprehensive strategies which call for every possible effort in all the sectors. 83 figs., 92 tabs.

49470 (OE/RT–90-03626-Vol.2, pp. 437-448, Paper E14) **Costs of alternate strategies for reducing nitrogen oxide and volatile organic compounds. Emissions from stationary sources in Ontario.** Sanger, T. (VHB Research and Consulting Inc., Toronto, ON (Canada)); Heeney, D.; Victor, P.; Reynolds, R. Ontario Ministry of the Environment, Toronto, ON (Canada). Research and Technology Branch. 1989. (CONF-8911230–: Environmental research: technology transfer conference, Toronto (Canada), 20-21 Nov 1989; MICROLOG–90-03625). In *Proceedings [of the] Environmental research: Technology transfer conference: Volume 2. Liquid and solid waste, analytical methods, environmental socio-economics.* Source: PC Publications Ontario, 880 Bay St, 5th Floor, Toronto, ON, CAN M7A 1N8; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $6.00 CAN; MF $10 CAN.

Efforts to reduce ozone levels have concentrated on the control of precursor compounds: nitrogen oxides (NO_x) and volatile organic compounds (VOCs). Sarnia and the metropolitan belt along the Oshawa-Toronto-Hamilton corridor are the major sources of NO_x and VOCs emissions in Ontario. A breakdown by source and geographic location of NO_x and VOCs is given; industry, commercial businesses and the residential sector, for example, are responsible for 34% of the NO_x emissions in the test area; and the chemical products and petroleum refining industries are each responsible for 6% of the the VOC emission in the same area. The objectives of this study are to estimate capital and operating costs for applicable abatement technologies for stationary sources of these types of emissions; to develop abatement cost functions; and to estimate the costs of achieving three abatement strategies, namely lowest achievable emission rate (LAER) scenerio, minimum control level on all sources scenario, and least cost scenario. Results indicate that large savings (in the order of millions) in abatement costs can be achieved by adopting a least cost control strategy. Estimated abatement costs should be matched to the estimates of the benefits from pollution abatement from each source to estimate net benefits controlling each source. Adopting a minimum control level strategy can be justified on two grounds: costs of planning, monitoring and enforcement can be lower than under a least cost strategy; and an equal level minimum control level for all sources on the surface seems fairer than a selective least cost strategy. 4 refs., 4 figs., 2 tabs.

49471 (OE/RT–90-03626-Vol.2, pp. 431-436, Paper E13) **Study of the options for reduction of energy-related greenhouse gas emissions.** Ontario Ministry of the Environment, Toronto, ON (Canada). Research and Technology Branch. 1989. (CONF-8911230–: Environmental research: technology transfer conference, Toronto (Canada), 20-21 Nov 1989; MICROLOG–90-03625). In *Proceedings [of the] Environmental research: Technology transfer conference: Volume 2. Liquid and solid waste, analytical methods, environmental socio-economics.* Source: PC Publications Ontario, 880 Bay St, 5th Floor, Toronto, ON, CAN M7A 1N8; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $6.00 CAN; MF $10 CAN.

The World Resources Institute estimates the three leading contributors to the greenhouse effect are carbon dioxide, methane and chlorofluorocarbons (CFCs). This paper discusses ways to reduce energy-related emissions of these gases, with carbon dioxide being the principle focus. For CFCs, eventual elimination appears to be technically and economically achievable due to the availability of substitutes or alternatives in the next 5 to 8 years. For methane, measures to capture and use fugitive methane are technically and economically feasible in many situations. The principle need is for regulations or incentives to encourage collection and use of the methane and to create markets for the gas and/or electricity produced. Reduction of carbon dioxide can be achieved through: improved energy efficiency of fossil fuel use in the residential, commercial, industrial, and transportation sectors; improved efficiency in the use of electricity through the demand side management measures; increased cogeneration and use of electrotechnologies; and substitution of non-fossil generation for remaining planned and existing fossil fueled generation. 2 tabs.

49472 (OH/RD–89-262-K) **Measurement of biogenic and anthropogenic volatile organic compounds during the Canadian Atmospheric Study, July 17 to August 31, 1988.** Handy, B. Ontario Hydro, Toronto, ON (Canada). Research Div. 27 Oct 1989. 170p. (MICROLOG–90-03532). Source: PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

A technique for measuring ambient concentrations of biogenic and anthropogenic volatile organic compounds (VOCs) was developed and used to analyze air samples obtained during the Canadian Atmospheric Chemistry Study at Dorset and Egbert, Ontario, from July to August, 1988. The data gathered is to be used to examine the observed mixing ratios of different classes of VOCs to determine the relative contribution of natural and anthropogenic sources towards the local oxidant abundance, and to test the predictive capability of the Canadian and US Eulerian long-range transport models (ADOM and RADM). A technique has been developed for the cryogenic concentration and gas chromatographic analysis of condensible species in air. The experimental procedure, including sampling, the operation of the analytical system, its calibration, and the precision and limits of detection are discussed. This report lists the observed concentrations determined by this new procedure, and it is shown to be suitable for the concentration of hydrocarbons in the range C3 to C12 in samples of ambient air. The overall precision of the method is about 12% and its detection threshold is about 0.50 $\mu g/m^3$. Suggested improvements to the measurement technique are included. 4 refs., 3 figs., 158 tabs.

49473 (OH/RD–403G348) **The role of clouds and precipitation in the long-range transport of air pollutants and acid rain formation in Canada: Phase 2. Programming, testing and refining of cloud dynamics, microphysics and chemistry models.** Cho, H.-R. (Dept. of Physics, Univ. of Toronto, Toronto, ON (Canada)); Iribarne, J.-V.; Soong, S.-T. Ontario Hydro, Toronto, ON (Canada). Research Div. Apr 1990. 159p. (CE–03122). Source: Canadian Electrical Association, One Westmount Square, Suite 500, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

Models of cloud microphysics and chemistry have been developed and then applied in a variety of cloud dynamic situations. The cloud microphysics model describes the physcial changes water undergoes in clouds. The cloud chemistry model describes the exchange of chemicals between the gas and liquid phases and between different hydrometeors, as well as the chemical reactions that go on in the cloud. Attention was focussed on SO_2 and its oxidants, as well as NO_2. When these models were interfaced to a time-dependent dynamical model of cumulus clouds, it was demonstrated that these clouds are very efficient at redistributing pollutants vertically in the atmosphere, and that the fraction of SO_2 entrained into the cloud that ends up as acid deposition is a very nonlinear function of the SO_2 concentration in the boundary layer air. Application of the cloud microphysics and chemistry models interfaced to a model of a front indicatd that the relationship between acid deposition and SO_2concentration in the boundary layer is nearly linear, when the entire cloud domain and lifetime are considered. Finally, the cloud microphysics and chemistry models, as well as an SO_2/NO_x emissions data base and a simple description of dry deposition, were implemented in a Eulerian transport model. The resulting model was then used to simulate a 12-h period of the OSCAR 4 (Oxidation and Scavenging Characteristics of April Rains) experiment. The predicted fields of cloud, precipitation and pollutant concentrations agreed qualitatively with available observational data. 28 refs., 68 figs., 8 tabs.

49474 (PB–90-234006/XAB) **Best demonstrated available technology (BDAT) background document. Final, May 1990.** Versar, Inc., Springfield, VA (USA). May 1990. 1770p. Source: NTIS, PC EE99/MF E99.

Set includes PB–90-234014 through PB–90-234253.

A separate abstract is included for each of 23 volumes of this set.

49475 (PB–90-234014/XAB) **Final best demonstrated available technology (BDAT) background document for K031, K084, K101, K102, characteristic arsenic wastes (D004), characteristic selenium wastes (D010), and P and U wastes containing arsenic and selenium listing constituents. Volume 1.** Rosengrant, L.; Fargo, L. Versar, Inc., Springfield, VA (USA). May 1990. 124p. Contract EPA-68-W9-0068. Source: NTIS, PC A06/MF A01.

See also PB–90-234022; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The background document provides the Agency's technical support and rationale for the development of treatment standards for the constituents to be regulated for the above-mentioned wastes.

49476 (PB–90-234022/XAB) **Final best demonstrated available technology (BDAT) background document for characteristic ignitable wastes (D001), characteristic corrosive wastes (d002), characteristic reactive wastes (D003), and P and U wastes containing reactive listing constituents. Volume 2.** Rosengrant, L.; Craig, R. Versar, Inc., Springfield, VA (USA). May 1990. 245p. Contract EPA-68-W9-0068. Source: NTIS, PC A11/MF A02.

See also Volume 1, PB–90-234014 and Volume 3, PB–90-234030; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The background document presents the Agency's technical support for selecting and developing the treatment standards for D001, D002, D003, and P and U wastes containing reactive listing constituents. Section 1 presents waste-specific information; Section 2 describes the industries that will be affected by the land disposal restrictions for the specific characteristic waste; Section 3 discusses applicable technologies that can be used to treat the waste; and Section 4 identifies the BDAT.

49477 (PB–90-234030/XAB) **Final best demonstrated available technology (BDAT) background document for K001 (addendum) and U051 (creosote). Volume 3.** Rosengrant, L.; Eby, E. Versar, Inc., Springfield, VA (USA). May 1990. 43p. Contract EPA-68-W9-0068. Source: NTIS, PC A03/MF A01.

See also Volume 2, PB–90-234022 and Volume 4, PB–90-234048; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The background document provides the Agency's technical support and rationale for the development of treatment standards for the constituents to be regulated for the above-mentioned wastes. The addendum provides the mathematical corrections to the original K001 treatment standards and presents the corrected K001 performance data and calculation of the revised K001 standards and U051 (creosote) standards.

49478 (PB–90-234048/XAB) **Final best demonstrated available technology (BDAT) background document addendum for K015. Volume 4.** Rosengrant, L.; Eby, E. Versar, Inc., Springfield, VA (USA). May 1990. 34p. Contract EPA-68-W9-0068. Source: NTIS, PC A03/MF A01.

See also Volume 3, PB–90-234030 and Volume 5, PB–90-234055; Also available in set of 25 reports, PC E99/MF E99, PB–90-234006.

The document is an addendum to the supporting BDAT background document for K015 dated August 1988. Most of the information regarding untreated K015 waste and K015 wastewater standards is available in the original background document and its references. The addendum reflects only revisions pertaining to K015 nonwastewater standards development. According to 40 CFR 261.32, waste code K015 is generated by the organic chemicals industry and is listed as still bottoms from the distillation of benzyl chloride. Because of the high organic concentrations in K015 (88% benzal chloride), the Agency has determined that the BDAT for K015 waste is incineration. After promulgation of the final First Third rule, EPA learned from a K015 generator that incineration of K015 generates an ash residue. Additionally, treatment of wastewater residuals such as incineration scrubber water and landfill leachate might form nonwastewater residuals. Therefore, EPA is revising the no land disposal standard by developing numerical standards for K015 nonwastewaters to reflect these new issues.

49479 (PB–90-234055/XAB) **Final best demonstrated available technology (BDAT) background document for K073. Volume 5.** Rosengrant, L.; Eby, E. Versar, Inc., Springfield, VA (USA). May 1990. 64p. Contract EPA-68-W9-0068. Source: NTIS, PC A04/MF A01.

See also Volume 4, PB–90-234048 and Volume 6, PB–90-234063; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The document explains how EPA determines BDAT, selects constituents for regulation, and calculates treatment standards. Section 2 presents waste-specific information–the number and location of facilities affected by the land disposal restrictions, the waste-generating process, and waste characterization data. These data serve as a basis for determining whether a variance from treatment standards may be warranted for a particular type of K073 that is more difficult to treat than the wastes that were analyzed in developing the treatment standards for K073. Section 3 discusses the technologies used to treat the waste (or similar wastes), and Section 4 presents available performance data, including data on which the treatment standards are based. Section 5 explains EPA's determination of BDAT, while Section 6 discusses the selection of constituents to be regulated. The treatment standards are determined in Section 7.

49480 (PB–90-234063/XAB) **Final best demonstrated available technology (BDAT) background document for K021. Volume 6.** Rosengrant, L.; Eby, E. Versar, Inc., Springfield, VA (USA). May 1990. 66p. Contract EPA-68-W9-0068. Source: NTIS, PC A04/MF A01.

See also Volume 5, PB–90-234055 and Volume 7, PB–90-234071; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The background document provides the Agency's technical support and rationale for selecting and developing the treatment standards for the constituents to be regulated in K021 waste. The document explains how EPA determines BDAT, selects constituents for regulation, and calculates treatment standards. Section 2 presents waste-specific information–the number and location of facilities affected by the land disposal restrictions, the waste-generating process, and waste characterization data. These data serve as a basis for determining whether a variance from treatment standards may be warranted for a particular type of K021 that is more difficult to treat than the wastes that were analyzed in developing the treatment standards for K021. Section 3 discusses the technologies used to treat the waste (or similar wastes), and Section 4 presents available performance data, including data on which the treatment standards are based. Section 5 explains EPA's determination of BDAT, while Section 6 discusses the selection of constituents to be regulated. The treatment standards are determined in Section 7.

49481 (PB–90-234071/XAB) **Final best demonstrated available technology (BDAT) background document for K086 (ink-formulation-equipment cleaning wastes). Volume 7.** Rosengrant, L.; Labiosa, J. Versar, Inc., Springfield, VA (USA). May 1990. 84p. Contract EPA-68-W9-0068. Source: NTIS, PC A05/MF A01.

See also Volume 6, PB–90-234063 and Volume 8, PB–90-234089; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

In today's rule, EPA is adopting a modified approach for the November 22, 1989, proposed rule (54 FR 48372) revisions for K086 (solvent wash) including the addition of seven new constituents for regulation and to revise the August 17, 1988, promulgated treatment standards for them. The proposed revisions relied exclusively on incineration performance data for the development of treatment standards. In response to comments, EPA modified and developed the proposed revisions to include treatment standards based on residuals generated from various wastewater treatment processes rather than incineration scrubber

waters (Sections 4 through 7 contain a discussion of these additional data). The final revisions for K086 (solvent washes) would apply to all forms of K086 wastewaters and nonwastewaters (Section 4 contains detailed information regarding these revisions). The background document presents the additional data and analyses that are the support for the promulgated K086 treatment standards. The background document is an addendum to the August 1988 background document for K086 solvent wash (USEPA 1988a).

49482 (PB–90-234089/XAB) **Final best demonstrated available technology (BDAT) background document for K060. Volume 8.** Rosengrant, L.; Chatmon-McEaddy, M. Versar, Inc., Springfield, VA (USA). May 1990. 41p. Contract EPA-68-W9-0068. Source: NTIS, PC A03/MF A01.

See also Volume 7, PB–90-234071 and Volume 9, PB–90-234097; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The background document provides the Agency's technical support and rationale for selecting and developing the proposed treatment standards for the constituents to be regulated to K060 waste. The document explains how EPA determines BDAT, selects constituents for regulation, and calculates treatment standards. Section 2 presents waste-specific information–the number and location of facilities affected by the land disposal restrictions, the waste-generating process, and waste characterization data. These data serve as a basis for determining whether a variance from treatment standards may be warranted for a particular type of K060 that is more difficult to treat than the wastes that were analyzed in developing the K060 treatment standards. Section 3 discusses the technologies used to treat the waste (or similar wastes), and Section 4 presents available performance data, including data on which the treatment standards are based. Section 5 explains EPA's determination of BDAT, while Section 6 discusses the selection of constituents to be regulated. The treatment standards are determined in Section 7.

49483 (PB–90-234097/XAB) **Final best demonstrated available technology (BDAT) background document for K061 (Addendum). Volume 9.** Rosengrant, L.; Chatmon-McEaddy, M. Versar, Inc., Springfield, VA (USA). May 1990. 48p. Contract EPA-68-W9-0068. Source: NTIS, PC A03/MF A01.

See also Volume 8, PB–90-234089 and Volume 10, PB–90-234105; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The background document presents the technical support and rationale for the promulgation of treatment standards for K061 wastewaters. Treatment standards for nonwastewater forms of K061 were promulgated in the First Third final rule (53 FR 31138, August 17, 1988). The background document is issued as an addendum to the August 1988 background document for K061 (USEPA 1988a), which accompanied the rulemaking for nonwastewater forms of K061. The document presents information specific to the treatment of K061 wastewaters and the technologies that were evaluated in the determination of best demonstrated available technology (BDAT) for K061 wastewaters. The Agency is promulgating standards for the same four BDAT list metal constituents that are regulated in K061 nonwastewaters–cadmium, chromium, lead, and nickel.

49484 (PB–90-234105/XAB) **Final best demonstrated available technology (BDAT) background document for K046 (Addendum). Volume 10.** Rosengrant, L.; Eby, E. Versar, Inc., Springfield, VA (USA). May 1990. 46p. Contract EPA-68-W9-0068. Source: NTIS, PC A03/MF A01.

See also Volume 9, PB–90-234097 and Volume 11, PB–90-234113; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The Environmental Protection Agency (EPA) is establishing best demonstrated available technology (BDAT) treatment standards for the listed waste identified in 40 CFR 261.32 as K046 (wastewater treatment sludges from the manufacturing, formulation, and loading of lead-based initiating compounds). If the treatment standards presented in the document are promulgated, compliance will be a prerequisite for placement of certain types of K046 waste in units designated as land disposal units according to 40 CFR Part 268. The effective date of these treatment standards would be June 9, 1990. In August 1988, EPA established two subcategories for K046 waste–reactive and nonreactive–and promulgated a treatment standard for nonwastewaters in the nonreactive subcategory (see 53 FR 31138, August 17, 1988). The development of that treatment standard was described in the BDAT background document for the K046 nonreactive subcategory (USEPA 1988a). The treatment standard, a concentration-based standard for lead, was based on performance data from stabilization of a nonreactive K046 waste.

49485 (PB–90-234113/XAB) **Final treatment standards for K069 nonwaste waters in the calcium sulfate/sodium subcategory and waste-water forms of K069. Volume 11. Memorandum report.** Paintal, A.S.; Chatmon-McEaddy, M. Versar, Inc., Springfield, VA (USA). 7 May 1990. 42p. Contract EPA-68-W9-0068. Source: NTIS, PC A03/MF A01.

See also Volume 10, PB–90-234105 and Volume 12, PB–90-234121; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The memorandum presents the technical support and rationale for the development of treatment standards for K069 nonwastewaters in the calcium sulfate subcategory and wastewater forms of K069.

49486 (PB–90-234121/XAB) **Final treatment standards for nonwaste-water and waste-water forms of K100. Volume 12. Memorandum report.** Paintal, A.S. Versar, Inc., Springfield, VA (USA). 8 May 1990. 38p. Contract EPA-68-W9-0068. Source: NTIS, PC A03/MF A01.

See also Volume 11, PB–90-234113 and Volume 13, PB–90-234139; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The memorandum presents the technical support and rationale for the development of treatment standards for nonwastewater and wastewater forms of K100. According to 40 CFR Part 261.32 (hazardous wastes from specific sources), waste code K100 is listed as waste leaching solution from acid leaching of emission control dust/sludge from secondary lead smelting. Treatment standards for K100 wastes were originally scheduled to be promulgated as part of the Third Third rulemaking. However, a treatment standard of No Land Disposal Based on No Generation for K100 nonwastewaters was promulgated on August 8, 1988, and was subsequently revised on May 1, 1989, (54 FR 18836) to be applicable only to nonwastewater forms of these wastes generated by the process described in the listing description and disposed after August 17, 1988, and not generated in the course of treating wastewater forms of these wastes (Based on No Generation).

49487 (PB–90-234139/XAB) **Final best demonstrated available technology (BDAT) background document for F006 waste waters (Addendum). Volume 13.** Rosengrant, L.; Chatmon-McEaddy, M. Versar, Inc., Springfield, VA (USA). May 1990. 80p. Contract EPA-68-W9-0068. Source: NTIS, PC A05/MF A01.

See also Volume 12, PB–90-234121 and Volume 14, PB–90-234147; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The document provides the Agency's rationale and technical support for selecting the constituents to be regulated in F006 wastewaters and for developing treatment standards for those regulated constituents. The document is an addendum to the supporting best demonstrated available technology (BDAT) background documents for F006 nonwastewaters. Treatment standards for metal constituents in F006 nonwastewaters were presented in the F006 background document dated August 1988 (USEPA) 1988a; treatment standards for cyanides in F006 nonwastewaters were presented in a background document for cyanide wastes dated June 1989 (USEPA) 1989a. Information regarding untreated F006 waste and F006 nonwastewater standards can be accessed through these background documents. The addendum contains only information pertaining to the development of treatment standards for F006 wastewaters.

49488 (PB–90-234147/XAB) **Final best demonstrated available technology (BDAT) background document addendum for cyanide wastes. Volume 14.** Rosengrant, L.; Chatmon-McEaddy, M. Versar, Inc., Springfield, VA (USA). May 1990. 103p. Contract EPA-68-W9-0068. Source: NTIS, PC A06/MF A01.

See also Volume 13, PB–90-234139 and Volume 15, PB–90-234154; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The document provides the Agency's rationale and technical support for selecting the constituents to be regulated in F019 nonwastewaters and wastewaters and for developing proposed best demonstrated available technology (BDAT) treatment standards for those regulated constituents. The document is an addendum to the BDAT Background Document for Cyanide Wastes (F006-F012), dated June 1989. In the Second Third Final Rule (54 FR 26611), the Agency promulgated a treatment standard for total cyanide in F006 through F009 nonwastewaters as 590 mg/kg. While the Agency stated that F019 wastes were different from F006-F009 wastes because the F019 wastes contained high concentrations of iron-cyanide complexes, review of the waste characterization data for F006 wastes indicates that many F006 wastes also contain high concentrations of iron-cyanide complexes that are somewhat similar. Based on this information, the Agency is promulgating treatment standards for F019 based on a transfer from F006 wastes.

49489 (PB–90-234154/XAB) **Final best demonstrated available technology (BDAT) background document addendum for acrylonitrile wastes (K011, K013, and K014). Volume 15.** Rosengrant, L.; Chatmon-McEaddy, M. Versar, Inc., Springfield, VA (USA). May 1990. 67p. Contract EPA-68-W9-0068. Source: NTIS, PC A04/MF A01.

See also Volume 14, PB–90-234147 and Volume 16, PB–90-234162; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The background document presents the technical support and rationale for the development of treatment standards for K011/K013/K014 wastewaters. The document presents information specific to the treatment of K011/K013/K014 wastewaters and the technologies that were evaluated in the determination of best demonstrated available technology (BDAT) for K011/K013/K014 wastewaters. The Agency is regulating the same five BDAT list constituents that are regulated in K011/K013/K014 nonwastewaters (acetonitrile, acrylonitrile, acrylamide, benzene, and cyanide). These standards are based on the treatment performance of wet air oxidation. The treatment standards for K011/K013/K014 wastewaters are presented in the document.

49490 (PB–90-234162/XAB) **Final best demonstrated available technology (BDAT) background document addendum for F002 (1,1,2-trichloroethane) and F005 (benzene, 2-ethoxyethanol, and 2-nitropropane). Volume 16.** Rosengrant, L.; Labiosa, J. Versar, Inc., Springfield, VA (USA). May 1990. 64p. Contract EPA-68-W9-0068. Source: NTIS, PC A04/MF A01.

See also Volume 15, PB–90-234154 and Volume 17, PB–90-234170; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The background document presents the data and rationale for the development of treatment standards for 1,1,2-trichloroethane (F002), benzene (F005), 2-ethoxyethanol (F005), and 2-nitropropane (F005). The document is issued as an addendum to the November 1986 background document for F001-F005 spent solvents (USEPA 1986).

49491 (PB–90-234170/XAB) **Final best demonstrated available technology (BDAT) background for mercury-containing wastes D009, K106, P065, P092, and U151. Volume 17.** Rosengrant, L.; Labiosa, J. Versar, Inc., Springfield, VA (USA). May 1990. 164p. Contract EPA-68-W9-0068. Source: NTIS, PC A08/MF A01.

See also Volume 16, PB–90-234162 and Volume 18, PB–90-234188; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The background document provides the Agency's technical support and rationale for the development of treatment standards for the constituents to be regulated for the above-mentioned wastes. Section 2 describes the potential industries affected by regulation of these wastes, explains the potential processes generating these wastes, and presents available waste characterization data. Section 3 specifies the applicable and demonstrated treatment technologies for these wastes. Section 4 contains performance data for the demonstrated technologies, and Section 5 analyzes these performance data to determine BDAT for each waste. Sections 6 and 7 provide rationale and treatment standards, respectively.

49492 (PB–90-234188/XAB) **Final best demonstrated available technology (BDAT) background document for P and U thallium wastes. Volume 18.** Rosengrant, L.; Craig, R.M. Versar, Inc., Springfield, VA (USA). May 1990. 31p. Contract EPA-68-W9-0068. Source: NTIS, PC A03/MF A01.

See also Volume 17, PB–90-234170 and Volume 19, PB–90-234196; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The background document provides the Agency's technical support and rationale for the development of treatment standards for the constituents to be regulated for the above-mentioned wastes. Sections 2 through 6 present waste-specific information for the thallium-containing wastes.

49493 (PB–90-234196/XAB) **Final best demonstrated available technology (BDAT) background document for vanadium-containing wastes (P119 and P120). Volume 19.** Rosengrant, L.; Craig, R.M. Versar, Inc., Springfield, VA (USA). May 1990. 33p. Contract EPA-68-W9-0068. Source: NTIS, PC A03/MF A01.

See also Volume 18, PB–90-234188 and Volume 20, PB–90-234204; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The background document presents the Agency's technical support and rationale for developing regulatory standards for these wastes. Sections 2 through 6 present waste-specific information for P119 and P120 wastes. Section 2 presents the number and location of facilities affected by the land disposal restrictions, the waste-generating processes, and waste characterization data. Section 3 discusses the technologies used to treat the wastes (or similar wastes), and Section 4 presents available performance data, including data upon which the treatment standards are based. Section 5 explains EPA's determination of BDAT. Treatment standards for vanadium wastes are determined in Section 6.

49494 (PB–90-234204/XAB) **Final best demonstrated available technology (BDAT) background document for barium wastes (D005 and P013). Volume 20.** Rosengrant, L.; Craig, R.M. Versar, Inc., Springfield, VA (USA). May 1990. 46p. Contract EPA-68-W9-0068. Source: NTIS, PC A03/MF A01.

See also Volume 19, PB–90-234196 and Volume 21, PB–90-234212; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The background document presents the Agency's technical support and rationale for developing regulatory standards for barium-containing wastes. Section 2 describes the industries affected by the regulation of D005 wastes, explains the processes generating these wastes, and presents available waste characterization data. Section 3 specifies the applicable and demonstrated treatment technologies for D005 wastes. Section 4 presents available performance data for the demonstrated technologies, including data upon which treatment standards are based. Section 5 contains analyses of the performance data to determine BDAT, and Section 6 contains the determination of the proposed treatment standards for the regulated constituent (barium). Section 7 discusses the listed waste P013 - barium cyanide and details the development of the treatment standard for these wastes.

49495 (PB–90-234212/XAB) **Final best demonstrated available technology (BDAT) background document for D006 cadmium wastes. Volume 21.** Rosengrant, L.; Labiosa, J.E. Versar, Inc., Springfield, VA (USA). May 1990. 47p. Contract EPA-68-W9-0068. Source: NTIS, PC A03/MF A01.

See also Volume 20, PB–90-234204 and Volume 22, PB–90-234220; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The background document presents the Agency's rationale and technical support for developing regulatory standards for these wastes. Section 2 presents the number and location of facilities believed to be affected by the land disposal restrictions, the waste-generating process, and waste characterization data. It is possible that other industrial operations generating cadmium wastes may

not have been covered in Section 2. Section 3 discusses the technologies used to treat the waste (or similar wastes), and Section 4 presents available performance data, including data on which treatment standards are based. Section 5 explains EPA's determination of BDAT. The treatment standards for cadmium wastes are determined in Section 6.

49496 (PB–90-234220/XAB) **Final best demonstrated available technology (BDAT) background document for chromium wastes D007 and U032. Volume 22.** Rosengrant, L.; Labiosa, J. Versar, Inc., Springfield, VA (USA). May 1990. 84p. Contract EPA-68-W9-0068. Source: NTIS, PC A05/MF A01.

See also Volume 21, PB–90-234212 and Volume 23, PB–90-234238; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The background document provides the Agency's technical support and rationale for the development of treatment standards for the constituents to be regulated for the above-mentioned chromium-containing wastes. Section 2 describes the industries affected by regulation of these wastes, explains the processes generating these wastes, and presents available waste characterization data. Section 3 specifies the applicable and demonstrated treatment technologies for these wastes. Section 4 contains performance data for the demonstrated technologies, and Section 5 contains analyses of these performance data to determine BDAT for each waste. Section 6 contains the determination of BDAT treatment standards for the regulated constituent (chromium). Section 7 discusses an associated chromium-containing U-code waste (U032 - calcium chromate) and details the development of the treatment standards for this waste.

49497 (PB–90-234238/XAB) **Final best demonstrated available technology (BDAT) background document for D008 and P and U lead wastes. Volume 23.** Rosengrant, L.; Chatmon-McEaddy, M. Versar, Inc., Springfield, VA (USA). May 1990. 58p. Contract EPA-68-W9-0068. Source: NTIS, PC A04/MF A01.

See also Volume 22, PB–90-234220 and Volume 24, PB–90-234246; Also available in set of 25 reports PC E99/MF E99, PB–90-234006.

The background document provides the Agency's technical support and rationale for the development of promulgated treatment standards for the constituents to be regulated for the lead-containing wastes. Section 2 describes the industries affected by regulation of these wastes, explains the processes generating these wastes, and presents available waste characterization data. Section 3 specifies the applicable and demonstrated treatment technologies for these wastes. Section 4 contains performance data for the demonstrated technologies, Section 5 analyzes these performance data to determine BDAT for each waste, and Section 6 presents the promulgated BDAT treatment standards for the regulated constituents. Section 7 discusses associated lead-containing P- and U-code wastes and details the development of the treatment standards for these wastes.

49498 (PB–90-234279/XAB) **Best demonstrated available technology (BDAT) background document for wastes.** Versar, Inc., Springfield, VA (USA). May 1990. 1985p. Source: NTIS, PC EE99/MF E99.

Set includes PB–90-234287 through PB–90-234469.

A separate abstract is included for each of 19 volumes of this set.

49499 (PB–90-234287/XAB) **Best demonstrated available technology (BDAT) background document for wastes from the production of chlorinated aliphatics F025. Volume 1. Final report.** Rosengrant, L.; Eby, E. Versar, Inc., Springfield, VA (USA). May 1990. 93p. Contract EPA-68-W9-0068. Source: NTIS, PC A05/MF A01.

See also Volume 2, PB–90-234295; Also available in set of 19 reports PC E99/MF E99, PB–90-234279.

The background document provides the Agency's rationale and technical support for selecting the constituents to be regulated in F025 and for developing treatment standards for these constituents. Section 2 presents waste-specific information, i.e., the industry affects and waste characterization. Section 3 discusses the applicable and demonstrated technologies used to treat the waste (or similar wastes) and Section 4 summarizes the available performance data, including data on which the treatment standards are based. Section 5 explains EPA's determination of BDAT, while Section 6 discusses the calculation of BDAT treatment standards.

49500 (PB–90-234295/XAB) **Treatment standards for nonwaste-water and waste-water forms of K044, K045, and K047. Volume 2. Final report.** Berkes, J. Versar, Inc., Springfield, VA (USA). 8 May 1990. 6p. Contract EPA-68-W9-0068. Source: NTIS, PC A02/MF A01.

See also Volume 1, PB–90-234287 and Volume 3, PB–90-234303. Also available in set of 19 reports PC E99/MF E99, PB–90-234279.

The background document provides the Agency's technical support and rationale for the development of treatment standards for the constituents to be regulated for the above-mentioned wastes.

49501 (PB–90-234303/XAB) **Best demonstrated available technology (BDAT) background document for U and P wastes and multisource leachates. Volume D. Reactive U and P waste waters and nonwaste waters. Final report.** Kinch, R.; Fargo, L. Versar, Inc., Springfield, VA (USA). May 1990. 84p. Source: NTIS, PC A05/MF A01.

See also Volume 2, PB–90-234295 and Volume 4, PB–90-234311. Also available in set of 19 reports PC E99/MF E99, PB–90-234279.

The background document provides the Agency's rationale and technical support for developing treatment standards for those U and P wastes with reactive listing constituents. These standards are applicable to the wastes as listed in 40 CFR 261.33(e) and (f) as well as to any wastes generated by the management or treatment of the listed waste.

49502 (PB–90-234329/XAB) **Amendment to the final best demonstrated available technology (BDAT) background document for wastes from the production of 1,1,1-trichloroethane K028, K029, K095, and K096. Final report.** Kinch, R.; Eby, E. Versar, Inc., Springfield, VA (USA). May 1990. 67p. Contract EPA-68-W9-0068. Source: NTIS, PC A04/MF A01.

See also Volume 4, PB–90-234311 and Volume 6, PB–90-234337. Also available in set of 19 reports PC E99/MF E99, PB–90-234279.

The background document provides the Agency's technical support and rationale for the development of treatment standards for the constituents to be regulated for the above-mentioned wastes.

49503 (PB–90-234337/XAB) **Best demonstrated available technology (BDAT) background document for U and P wastes and multi-source leachate (F039). Volume A. Wastewater forms of organic U and P wastes and multi-source leachate (F039) for which there are concentration-based treatment standards. Final report.** Kinch, R.; Cunningham, M. Versar, Inc., Springfield, VA (USA). May 1990. 481p. Contract EPA-68-W9-0068. Source: NTIS, PC A21/MF A03.

See also Volume 5, PB–90-234329 and Volume 7, PB–90-234345. Also available in set of 19 reports PC E99/MF E99, PB–90-234279.

The background document provides the Agency's technical support and rationale for the development of treatment standards for the constituents to be regulated for the above-mentioned wastes.

49504 (PB–90-234345/XAB) **Best demonstrated available technology (BDAT) background document for U and P wastes and multi-source leachate (F039). Volume B. U and P wastewaters and nonwaste waters with methods of treatment as treatment standards. Final report.** Kinch, R.; Jones, L. Versar, Inc., Springfield, VA (USA). 8 May 1990. 215p. Source: NTIS, PC A10/MF A02.

See also Volume 6, PB–90-234337 and Volume 8, PB–90-234352. Also available in set of 19 reports PC E99/MF E99, PB–90-234279.

The background document provides the agency's rationale and technical support for developing treatment standards for those U and P wastes with methods of treatment at the BDAT treatment standards. These standards are applicable to the wastes as listed in 40 CFR 261.33(e) and (f) as well as to any wastes generated by

the management or treatment of the listed waste. Treatment standards are specified for both nonwastewater and wastewater forms of each listed hazardous waste. Wastewaters are defined as wastes containing less than 1% (weight basis) total suspended solids and less than 1% (weight basis) total organic carbon (TOC). Wastes not meeting the wastewater definition must comply with treatment standards for nonwastewaters.

49505 (PB–90-234352/XAB) **Best demonstrated available technology (BDAT) background document for U and P wastes and multi-source leachate (F039). Volume C. Nonwastewater forms of organic U and P wastes and multi-source leachate (F039) for which there are concentration-based treatment standards. Final report.** Kinch, R.; Jones, L. Versar, Inc., Springfield, VA (USA). May 1990. 248p. Contract EPA-68-W9-0068. Source: NTIS, PC A11/MF A02.

See also Volume 7, PB–90-234345 and Volume 9, PB–90-234360; Also available in set of 19 reports PC E99/MF E99, PB–90-234279.

The document provides the Agency's rationale and technical support for developing concentration-based treatment standards for organic constituents in U and P nonwastewaters, for lead in U051 nonwastewaters, and for constituents in multi-source leachate nonwastewaters (F039). These standards are applicable to the wastes as listed as well as to any wastes generated by the management or treatment of the listed wastes. For the purpose of determining the applicability of the treatment standards, wastewaters are defined as wastes containing less than 1% (weight basis) total suspended solids and less than 1% (weight basis) total organic carbon (TOC). Wastes not meeting the wastewater definition must comply with treatment standards for nonwastewaters.

49506 (PB–90-234360/XAB) **Amendment to the final best demonstrated available technology (BDAT) background document for distillation bottom tars from the production of phenol/acetone from cumene K022. Final report.** Kinch, R.; Labiosa, J. Versar, Inc., Springfield, VA (USA). May 1990. 56p. Contract EPA-68-W9-0068. Source: NTIS, PC A04/MF A01.

See also Volume 8, PB–90-234352 and Volume 10, PB–90-234378. Also available in set of 19 reports PC E99/MF E99, PB–90-234279.

The amendment to the Final Best Demonstrated Available Technology (BDAT) Background Document for K022 presents EPA's rationale and technical support for selecting the constituents for regulation in wastewater forms of K022. Sections 2.0 through 6.0 of the document amend sections in the Final BDAT Background Document for K022 that refer to applicable and demonstrated treatment technologies, treatment performance data, accuracy-corrected data, constituents selected for regulation in wastewater forms of K022, and calculation of treatment standards, respectively. Section 7.0 contains acknowledgements and Section 8.0 lists references. Appendix A summarizes treatment performance data for organic constituents regulated in K022 wastewaters, and Appendix B contains quality assurance/quality control data for metal constituents regulated in K022 wastewaters.

49507 (PB–90-234378/XAB) **Best demonstrated available technology (BDAT) background document for distillation bottoms from the production of aniline K083. Final report.** Kinch, R.; Labiosa, J. Versar, Inc., Springfield, VA (USA). May 1990. 92p. Contract EPA-68-W9-0068. Source: NTIS, PC A05/MF A01.

See also Volume 9, PB–90-234360 and Volume 11, PB–90-234386. Also available in set of 19 reports PC E99/MF E99, PB–90-234279.

The background document provides the Agency's technical support and rationale for the development of treatment standards for the constituents to be regulated for the above-mentioned wastes. The document also provides waste characterization data that serve as a basis for determining whether a variance from a treatment standard may be warranted for a particular type of K083 that is more difficult to treat than the wastes that were analyzed in developing treatment standards for K083.

49508 (PB–90-234386/XAB) **Best demonstrated available technology (BDAT) background document for distillation bottoms from the production of nitrobenzene by the nitration of benzene K025. Final report.** Kinch, R.; Labiosa, J. Versar, Inc., Springfield, VA (USA). May 1990. 30p. Contract EPA-68-W9-0068. Source: NTIS, PC A03/MF A01.

See also Volume 10, PB–90-234378 and Volume 12, PB–90-234394. Also available in set of 19 reports PC E99/MF E99, PB–90-234279.

The background document provides the Agency's technical support and rationale for the development of treatment standards for the constituents to be regulated for the above-mentioned wastes. The document also provides waste characterization data that serve as a basis for determining whether a variance from the treatment standard may be warranted for a particular type of K025 that is more difficult to treat than the wastes on which the K025 treatment standards are based.

49509 (PB–90-234394/XAB) **Best demonstrated available technology (BDAT) background document for stripping still tails from the production of methyl ethyl pyridines K026. Final report.** Kinch, R.; Labiosa, J. Versar, Inc., Springfield, VA (USA). May 1990. 26p. Contract EPA-68-W9-0068. Source: NTIS, PC A03/MF A01.

See also Volume 11, PB–90-234386 and Volume 13, PB–90-234402. Also available in set of 19 reports PC E99/MF E99, PB–90-234402.

The background document provides the Agency's technical support and rationale for the development of treatment standards for the constituents to be regulated for the above-mentioned wastes. The document also provides waste characterization data that serve as a basis for determining whether a variance from the treatment standard may be warranted for a particular type of K026 that is more difficult to treat than the wastes on which the K026 treatment standards are based.

49510 (PB–90-234402/XAB) **Best demonstrated available technology (BDAT) background document for waste-water treatment sludges generated in the production of creosote K035. Final report.** Kinch, R.; Labiosa, J. Versar, Inc., Springfield, VA (USA). May 1990. 78p. Contract EPA-68-W9-0068. Source: NTIS, PC A05/MF A01.

See also Volume 12, PB–90-234394 and Volume 14, PB–90-234410. Also available in set of 19 reports PC E99/MF E99, PB–90-234279.

The background document provides the Agency's technical support and rationale for the development of treatment standards for the constituents to be regulated for the above-mentioned wastes. The document also provides waste characterization data that serve as a basis for determining whether a variance from a treatment standard may be warranted for a particular type of K035 that is more difficult to treat than the wastes that were analyzed in developing treatment standards for K035.

49511 (PB–90-234428/XAB) **Amendment to best demonstrated available technology (BDAT) background document for K037. Final report.** Kinch, R.; Cunningham, M. Versar, Inc., Springfield, VA (USA). May 1990. 25p. Contract EPA-68-W9-0068. Source: NTIS, PC A03/MF A01.

See also Volume 14, PB–90-234410 and Volume 16, PB–90-234436. Also available in set of 19 reports PC E99/MF E99, PB–90-234279.

The amendment to the Final Best Demonstrated Available Technology (BDAT) Background Document for K037 presents (1) a discussion of biological treatment as an applicable and demonstrated technology for reducing regulated constituents in organophosphorus wastewater streams, (2) performance data supporting biological treatment as an effective technology for treating organophosphorus wastewater streams, (3) rationale for transferring biological treatment performance data to wastewater forms of K037 and, (4) calculation of new numerical standards. Specifically, Section 2 of the document supplements Section 3 of the Final BDAT Background Document for K037 by introducing biological treatment as an applicable and demonstrated technology for treating wastewater forms of K037. Section 3 of the document amends Section 4 of the Final BDAT Background Document for K037 by adding performance data for biological treatment of parathion and toluene. Section 4 amends Section 5.2 by identifying biological treatment as BDAT for K037 wastewaters. Finally, Section 5

amends Section 7 by presenting revised numerical treatment standards for disulfoton and toluene in K037 wastewaters.

49512 (PB–90-234436/XAB) **Best demonstrated available technology (BDAT) background document for halogenated pesticide and chlorobenzene wastes K032-K034, K041, K042, K085, K097, K098, K105, D012-D017. Final report.** Kinch, R.; Eby, E. Versar, Inc., Springfield, VA (USA). May 1990. 154p. Contract EPA-68-W9-0068. Source: NTIS, PC A08/MF A01.

See also Volume 15, PB–90-234428 and Volume 17, PB–90-234444. Also available in set of 19 reports PC E99/MF E99, PB–90-234279.

The background document provides the Agency's technical support and rationale for the development of treatment standards for the constituents to be regulated for the above-mentioned wastes. The section describes the industry affected by the land disposal restrictions for the halogenated pesticide and chlorobenzene wastes included in Table 1-1, the processes generating the wastes, the available characterization data, and the determination of waste treatability groups.

49513 (PB–90-234444/XAB) **Amendment to the final best demonstrated available technology (BDAT) background document for wastes from the production of chlorinated aliphatic hydrocarbons F024. Final report.** Kinch, R.; Vorbach, J. Versar, Inc., Springfield, VA (USA). May 1990. 44p. Contract EPA-68-W9-0068. Source: NTIS, PC A03/MF A01.

See also Volume 16, PB–90-234436 and Volume 18, PB–90-234451. Also available in set of 19 reports PC E99/MF E99, PB–90-234279.

The amendment to the Final Best Demonstrated Available Technology (BDAT) Background Document for F024 presents: (1) F024 incinerator ash stabilization data; (2) EPA's rationale and technical support for selecting the metal constituents being regulated in nonwastewater forms of F024 and for deleting the chlorinated dibenzodioxins and dibenzofurans as regulated constituents in F024; (3) EPA's approach to and technical support for developing treatment standards for metal constituents in nonwastewater forms of F024; and (4) EPA's rationale and technical support for revising the F024 treatment standards promulgated for organic constituents in the Second Third rule. Sections 2.0 through 5.0 of the document supplement discussions in the Final BDAT Background Document for F024 by presenting treatment performance data, accuracy-corrected treatment performance data, constituents selected for regulation in F024, and treatment standard calculations, respectively. Section 6.0 contains acknowledgements, and Section 7.0 lists references.

49514 (PB–90-234469/XAB) **Best demonstrated available technology (BDAT) background document for U and P wastes and multi-source leachate (F039). Volume E. Gaseous U and P wastes. Final report.** Kinch, R.; Jones, L. Versar, Inc., Springfield, VA (USA). May 1990. 36p. Contract EPA-68-W9-0068. Source: NTIS, PC A03/MF A01.

See also Volume 18, PB–90-234451. Also available in set of 19 reports PC E99/MF E99, PB–90-234279.

The background document provides the Agency's technical support and rationale for the development of treatment standards for the constituents to be regulated for the above-mentioned wastes. The three gaseous U and P wastes are: ethylene oxide (U115), nitric oxide (P076), and nitrogen dioxide (P078). These standards are applicable to the wastes listed as well as to any wastes generated by the management or treatment of the listed wastes.

49515 (PB–90-234477/XAB) **Final response to BDAT related comments document.** Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 4811p. Source: NTIS, PC EE99/MF E99.

Set includes PB–90-234485 through PB–90-234667.

A separate abstract is included for each of 17 volumes of this set.

49516 (PB–90-234493/XAB) **Final response to BDAT related comments document: General BDAT issues. Volume 1-A-2.** Rosengrant, L.; Craig, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 236p. (EPA–530/SW-90/061B). Source: NTIS, PC A11/MF A02.

See also Volume 1-A-1, PB–90-234485 and Volume 1-A-3, PB–90-234501; Also available in set of 19 reports PC E99/MF E99, PB–90-234477.

The response to comments document only addressed those comments which were submitted on the proposed land disposal restrictions for those waste codes and general BDAT technologies and issues which related to Third Third Wastes Treatment Standards. The commenters presented in the document are grouped according to major concerns of the commenters. The document contains PQL, wastewaters/nonwastewaters, grab/composite samples, quantification complications for P and U wastes, and soil and debris.

49517 (PB–90-234501/XAB) **Final response to BDAT related comments document: General BDAT issues. Volume 1-A-3.** Rosengrant, L.; Craig, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 254p. (EPA–530/SW-90/061C). Source: NTIS, PC A12/MF A02.

See also Volume 1-A-2, PB–90-234493 and Volume 1-B, PB–90-234519; Also available in set of 19 reports PC E99/MF E99, PB–90-234477.

The contents of this article include the following: soil and debris; stabilization; recovery/recycling technologies; treatment standards for treatability groups; ammonia wastes; technology as treatment standard; treatment of residues; tclp vs. ep; analytical concerns; treatment standards for characteristic wastes; no land disposal; wastes with multiple characteristics; incineration/fuel substition; transfer of treatment standards or performance data; definition of k112; treatment standards for p and u wastes; and treatment technologies for metals; statistical analysis.

49518 (PB–90-234527/XAB) **Final response to BDAT related comments document: D002. Volume 1-C.** Rosengrant, L.; Craig, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 448p. (EPA–530/SW-90/061E). Source: NTIS, PC A19/MF A03.

See also Volume 1-B, PB–90-234519 and Volume 1-D, PB–90-234535; Also available in set of 19 reports PC E99/MF E99, PB–90-234477.

The contents include the following: proposed ph requirement; proposed insoluble salt requirements; incineration; dilution; and miscellaneous issues.

49519 (PB–90-234535/XAB) **Final response to BDATt related comments document D003. Volume 1-D.** Rosengrant, L.; Craig, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 324p. (EPA–530/SW-90/061F). Source: NTIS, PC A14/MF A02.

See also Volume 1-C, PB–90-234527 and Volume 1-E, PB–90-234543; Also available in set of 19 reports PC E99/MF E99, PB–90-234477.

The contents of this article include the following: deactivation technology alternatives; cyanide treatment standards; other cyanide issues; sulfide treatment alternatives; proposed insoluble salt requirement for sulfides; reactive sulfide definition; explosive, water reactive, and other reactive wastes; and p and u waste issues.

49520 (PB–90-234543/XAB) **Final response to BDAT related comments document. D004: Characteristic wastes for arsenic and K, P, and U wastes containing arsenic and D010: Characteristic wastes for selenium. Volume 1-E.** Rosengrant, L.; Craig, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 236p. (EPA–530/SW-90/061G). Source: NTIS, PC A11/MF A02.

See also Volume 1-D, PB–90-234535 and Volume 1-F, PB–90-234550; Also available in set of 19 reports PC E99/MF E99, PB–90-234477.

The contents of this article include the following: aqueous wastes are incompatible with vitrification; air emissions; scrubbers to control emissions from incinerators; chemical oxidation and stabilizations as bdat in lieu of vitrification; treatment of organoarsenic bu incineration in lieu of vitrification; furnaces permitting; vitrification residues; chemical treatment as bdat for arsenic; alternative

technologies to vitrification; vitrification is not demonstrated; vitrification technology is not available; stabilization as bdat for arsenic; stabilization unsatisfactory; vitrification data supplied; vitrification supported as bdat for as/se; tclp with glasses can give misleading results; bdat is technically flawed; stabilization as bdat for as/se; permitting vitrification devices; and specification of treatment standards.

49521 (PB–90-234550/XAB) **Final response to BDAT related comments document: D005: Characteristic wastes for barium, and P013 and D006: Characteristic wastes for cadmium. Volume 1-F.** Rosengrant, L.; Craig, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 210p. (EPA–530/SW-90/061H). Source: NTIS, PC A10/MF A02.

See also Volume 1-E, PB–90-234543 and Volume 1-G, PB–90-234568; Also available in set of 19 reports PC E999/MF E99, PB–90-234477.

The contents of this article include the following: characteristic wastes for barium and p013 (data submission, treatment standards, preamble vs. proposed rule, mclg standard, treatability group for barium wastes containing organics, and drinking water levels of barium); and characteristic wastes for cadmium (problems in management of household battery wastes, cadmium wastes not similar to f006 or k061, set standards for ep level, set treatment method instead of level, foundry wastes cannot meet standards, inconsistencies in setting standards, allowance of alternate technologies, stepwise recovery of more than one constituent may require processing at more than one site, most batteries are not hazardous wastes, and data submittal).

49522 (PB–90-234568/XAB) **Final response to BDAT related comments document. D007. Characteristic wastes for chromium. Volume 1-G.** Rosengrant, L.; Craig, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 334p. (EPA–530/SW-90/061I). Source: NTIS, PC A15/MF A02.

See also Volume 1-F, PB–90-234550 and Volume 1-H, PB–90-234576; Also available in set of 19 reports PC E99/MF E99, PB–90-234477.

The contents of this article include the following: treatment standards; treatment data; treatability of waste/group; total chromium vs hexavalent or trivalent chromium; miscellaneous; and comments on data.

49523 (PB–90-234576/XAB) **Final response to BDAT related comments document: D008: Characteristic wastes for lead and P and U wastes containing lead. Volume 1-H.** Rosengrant, L.; Craig, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 398p. (EPA–530/SW-90/061J). Source: NTIS, PC A17/MF A03.

See also Volume 1-G, PB–90-234568 and Volume 1-I, PB–90-234584; Also available in set of 19 reports PC E99/MF E99, PB–90-234477.

The contents of this article include the following: characteristic level as treatment technology; wastewaters treatment data; wastewaters - validity of transfer from k062; specific use of chemical precipitation; treatment data for nonwastewaters; validity of transfer of stabilization data to d008; stabilization as an effective treatment technology for lead wastes; application of recovery to d008 high level nonwastewaters; proposed cutoff level for recovery; and lead acid batteries-further specification of metal recovery.

49524 (PB–90-234584/XAB) **Final response to BDAT related comments document. D009, K044, K045, K047, D011, P119, P120, and P and U wastes. Volume 1-I.** Rosengrant, L.; Craig, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 246p. Contract EPA-68-W9-0068. (EPA–530/SW-90/061K). Source: NTIS, PC A11/MF A02.

See also Volume 1-H, PB–90-234576 and Volume 1-J, PB–90-234592. Also available in set of 19 reports PC E99/MF E99, PB–90-234477.

The contents of this article include the following: characteristic wastes for mercury p and u wastes containing mercury (data submission only, thermal recovery standard-demonstrability, establishment of bdat standard level below the characteristic level, stabilization as bdat or sulfide precipitated d009 as bdat, alternative treatment for debris and other wastes, reconsideration of the retort cutoff level, treatment standard mixed waste, and indigenous waste); wastes from the manufacturing and processing of explosives (treatment standard); characteristic wastes for silver (treatment standards, precipiation, and concentration-based standards vs. recovery or stabilization); vanadium containing wastes (treatment technology, waste classification, treatment standards, and data submission); and p and u wastes containing thallium (data submission).

49525 (PB–90-234592/XAB) **Final response to BDAT related comments document. Mixed radioactive hazardous wastes, polynuclear aromatic u wastes, halogenated aliphatic U wastes, non-halogenated aromatic U wastes, F002-f006, F019. Volume 1-J.** Rosengrant, L.; Craig, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 242p. (EPA–530/SW-90/061L). Source: NTIS, PC A11/MF A02.

See also Volume 1-I, PB–90-234584 and Volume 1-K, PB–90-234600. Also available in set of 19 reports PC E99/MF E99, PB–90-234477.

The contents of this article include the following: mixed radioactive hazardous wastes (radioactive lead wastes, radioactive mercury wastes, radioactive zirconium fines, and other radioactive wastes); polynuclear aromatic u wastes (treatment standards and recycling.reuse); halogenated aliphatic u wastes (treatment standards and bdat); non-halogenated aromatic u wastes (treatment standards and recycling/reuse); solvents (methods of detection, biological treatment, treatment standards, 2-nitropropane standard, and definition of wastewater and solvent mixtures); electroplating wastewater treatment sludges (wastewater definition, treatment standards, f006 subcategory, and analytical methods); and aluminum conversion coating treatment sludges (analytical methodology, bdat, and treatment standards).

49526 (PB–90-234600/XAB) **Final response to BDAT related comments document. F025, K002-K006, K011, K013-15, K046, K061, K069. volume 1-k.** Rosengrant, L.; Craig, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 232p. (EPA–530/SW-90/061M). Source: NTIS, PC A11/MF A02.

See also Volume 1-J, PB–90-234592 and Volume 1-L, PB–90-234618. Also available in set of 19 reports PC E99/MF E99, PB–90-234477.

The contents of this article include the following: wastes from production of chlorinated aliphatics (treatment standard); inorganic pigments (support standard, background document corrections, and sampling frequency); acrylonitrile (wastewater definition, acrylonitrile standard, performance data, numerical standard vs. wet air oxidation method, and data request); still bottoms from benzal chloride (nickel standard and organic standards); spent antimony catalyst (no comments were received for this waste code); ww treatment sludges from manufacturing, formulating, and loading of lead-based initiating compounds (treatment standard, stabilization technology, deactivation technology, waste minimization, and analytical data); ammonia still lime sludge (no comments were recieved for this waste code); electric arc furnace dust (wastewater treatment standard, high temperature metals recovery and residuals, treatment technologies for nonwastewaters, and availability of high temperature metals recovery); and emission control dust/sludge from secondary lead smelting (treatment standard).

49527 (PB–90-234626/XAB) **Final response to BDAT related comments document. K017/K028-K029, K095-096, K022, K025, K035, K026, K083, K024. Volume 1-M.** Rosengrant, L.; Craig, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 183p. (EPA–530/SW-90/061O). Source: NTIS, PC A09/MF A01.

See also Volume 1-L, PB–90-234618 and Volume 1-N, PB–90-234634. Also available in set of 19 reports PC E99/MF E99, PB–90-234477.

The contents of this document includes the following: wastes from the production of epichlorohydrin (no comments were received for this waste code); k028, k029, k095, k096 - production of 1,1,1-trichloroethane (nickel standard); wastewaters containing bdat

constituents (u and p wastewater standards and wastewaters containing bdat list constituents document); waste from the production of phenol/acetone (treatment standards and use of scrubber water data to establish wastewater treatment standards); distillation bottoms from the production of nitrobenzene (treatment standards for metals, use of scrubber water data to establish wastewater treatment standards); ww treatment sludges from the production of creosote (use of scrubber water data to establish wastewater treatment standards); stripping still tails from the production of methyl ethyl pyridine (no comments were received for this waste code); distillation bottoms from the production of aniline (use of scrubber water data to establish wastewater treatment standards); oxygenated hydrocarbons and heterocyclic u and p wastes (oxygenateds); and production of chlorinated aliphatic hydrocarbons (treatment standards, bdat for nonwastewater organics, and listing definitions for f024).

49528 (PB–90-234634/XAB) **Final response to BDAT related comments document. Halogenated organic wastes. Volume 1-N.** Rosengrant, L.; Craig, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 211p. (EPA–530/SW-90/061P). Source: NTIS, PC A10/MF A02.

See also Volume 1-M, PB–90-234626 and Volume 1-O, PB–90-234642. Also available in set of 19 reports PC E99/MF E99, PB–90-234477.

The contents of this document include the following: halogenated organic, pharmaceutical, brominated organic, organosulfur compound, and organo-nitrogen compound wastes (halogenated aliphatics, organonitrogen compounds, brominated compounds); treatment methods as treatment standards; thermal treatment/fuel substitution; pql/analytical issues; miscellaneous halogenateds; organosulfur compounds; and halogenated pesticide and chlorobenzene, halogenated phenolic, and phenolic wastes (phenolics and k085).

49529 (PB–90-234659/XAB) **Final response to BDAT related comments document. Leachates. Volume 1-P.** Rosengrant, L.; Craig, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 317p. (EPA–530/SW-90/061R). Source: NTIS, PC A14/MF A02.

See also Volume 1-O, PB–90-234642 and Volume 1-Q, PB–90-234667. Also available in set of 19 reports PC E99/MF E99, PB–90-234477.

The contents of this document include the following: options; definition; dioxin; analysis and monitoring; standards; permitting; allow combination of leachates to facilitate treatment; supplemental notice; characterization of wastes placed in pre-rcra units; clarification of contaminated with regarding multisource leachate and groundwater; use of effluent guidelines database; delay in mulisource leachate rule; and de minimus exemptions, and bdat vs. bat effluent guidelines.

49530 (PB–90-234667/XAB) **Final response to BDAT related comments document. Volume 1-Q.** Rosengrant, L.; Craig, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 58p. (EPA–530/SW-90/061S). Source: NTIS, PC A04/MF A01.

See also Volume 1-P, PB–90-234659. Also available in set of 19 reports PC E99/MF E99, PB–90-234477.

The contents of this document include the following: thermal and caustic solution destruction as alternatives to gas cylinder recovery; numerical standards for gas wastes in nongaseous forms; treatment methods for u115 (ethylene oxide); and treatment methods for u115 (ethylene oxide) nonwastewaters.

49531 (PB–90-244393/XAB) **Testing of indoor radon-reduction techniques in 19 Maryland houses. Final report, January 1987-June 1989.** Gilroy, D.G.; Kaschak, W.M. CDM Federal Programs Corp., Fairfax, VA (USA). Jun 1990. 289p. Source: NTIS, PC A13/MF A02.

See also PB–90-222704.

The report gives results of testing of indoor radon reduction techniques in 19 existing houses in Maryland. The focus was on passive measures: various passive soil depressurization methods, where natural wind and temperature effects are utilized to develop suction in the system; and sealing of radon entry routes into the house. Active (fan-assisted) soil depressurization techniques were also tested. Passive soil depressurization systems typically gave moderate radon reductions (30-70%), although the reductions ranged from zero to 90%. Only two houses were reduced <4 pCi/L with the passive systems. A passive system is most likely to be successful when sub-slab communication is very good, when the house has a basement with no adjoining slab-on-grade or crawlspace wings, and when the foundation walls are poured concrete instead of hollow block. Entry route sealing as a stand-alone radon mitigation measure gave zero-50% reduction in the only house where it was tested. Active soil depressurization, tested in 18 houses, reduced 16 of them <4 pCi/L, and 12 of them <2 pCi/L; reductions were often >90%. Poor sub-slab communication prevented this approach from being fully successful in the other two houses; later modifications to these two systems reduced these houses <4 pCi/L also.

49532 (PB–90-244807/XAB) **Biological sources and sinks of methane in tropical habitats and tropical atmospheric chemistry. Doctoral thesis.** Keller, M.M. National Center for Atmospheric Research, Boulder, CO (USA). 1990. 226p. Grant NAGW-833. (NCAR/CT–126). Source: NTIS, PC A11/MF A02.

The contents of this study include: two methods for measuring methane emission from a tropical lake; methane emission by bubbling from Gatun Lake, Panama; methane emission from wetlands in central Panama; consumption of atmospheric methane in soils of central Panama: effects of agricultural development; a seasonal study of soil-atmosphere methane, carbon dioxide, and 222Rn flux in a tropical moist forest; and the effects of tropical deforestation on global and regional atmospheric chemistry.

49533 (PB–90-247149/XAB) **Health assessment for Recticon/Allied Steel Corporation, Parkerford, Chester County, Pennsylvania, Region 3. CERCLIS No. PAD053302865. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 22 Jan 1990. 12p. Source: NTIS, PC A03/MF A01.

The Recticon/Allied Steel site was included in Update 7 of the National Priorities List. Together, the two facilities occupy about 5 acres of land in Parkerford, Chester County, Pennsylvania. Volatile organic solvents that were previously used at these facilities appear to have contaminated the underlying aquifer. This contamination has migrated off-site and has impacted numerous private wells. Trichloroethylene and 1,2-dichloroethylene have been detected in off-site wells at concentrations in excess of acceptable drinking water concentrations. The use of contaminated water for either potable or nonpotable purposes could lead to exposures by ingestion, inhalation, or dermal absorption. These exposures pose a public health concern and corrective actions should be implemented to mitigate further exposures.

49534 (PB–90-247156/XAB) **Health assessment for Gautier Oil Co., Inc., Gautier, Mississippi, Region 4. CERCLIS No.MSD098596489. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 25 Jun 1990. 18p. Source: NTIS, PC A03/MF A01.

The Gautier Oil Co., Inc., site–located in Gautier, Jackson County, Mississippi–has been proposed by the U.S. Environmental Protection Agency for addition (Update No. 7) to the National Priorities List. The site had been used for industrial purposes for approximately 100 years–first for wood preserving, and, more recently, for waste oil recovery. The site has been inoperative since 1984. Wastes at the site are known to include creosote, pentachlorophenol, and solvents. An extensive removal action completed in 1985 included removing tanks, lagoon liquids and sludge, visible sludge piles, visibly contaminated soils, buildings, drums, and trash. On the basis of the information reviewed, this site is of potential public health concern because humans may be exposed to hazardous substances at concentrations that may result in adverse health effects. Human exposure to chloroform, arsenic, and bis(2-ethylhexyl)phthalate may be occurring through ingestion of groundwater at some private water supply wells in the site vicinity.

49535 (PB–90-247172/XAB) **Health assessment for Kent County Landfill (Houston), Houston, Kent County, Delaware, Region 3. CERCLIS No. DED980705727. Preliminary report.**

Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 25 Jun 1990. 14p. Source: NTIS, PC A03/MF A01.

The Kent County Landfill (also known as Houston Landfill) site has been proposed for the National Priorities List (NPL) by the U.S. Environmental Protection Agency. The site is located about 4 miles southeast of Dover, Delaware. Approximately 20,000 persons reside within 3 miles of the site. Metals and organic compounds have been detected as a result of on-site ground water monitoring. Based on the information reviewed, the Agency for Toxic Substances and Disease Registry has concluded that this site is of potential public health concern because humans may be exposed to hazardous substances at concentrations that may result in adverse health effects. As noted in the Human Exposure Pathways Section, human exposure to organic contaminants and metals may occur via ingestion of, inhalation of, and dermal contact of contaminants in soil, ground water, and surface water; inhalation of contaminants in air; and ingestion of contaminants in food-chain entities. Additional information is needed to evaluate more fully the releases, migration, and resulting levels of these contaminants at points of potential human exposure.

49536 (PB–90-247339/XAB) **Nitrogen dioxide and respiratory infection: Pilot investigations. Research report, January 1984-September 1987.** Samet, J.M.; Spengler, J.D. New Mexico Univ., Albuquerque, NM (USA). School of Medicine. ©Sep 1989. 48p. Source: NTIS, PC A03/MF A01.

A longitudinal study has been designed of infants to determine if NO(sub 2) exposure from cooking stoves increases the incidence or severity of respiratory infections during the first 18 months of life. Results of pilot investigations for the longitudinal study, conducted from 1984-1986, are reported here. In the first study, 147 families of infants were recruited at two Albuquerque hospitals, and their homes were monitored for NO(sub 2) using a passive sampling tube. Higher levels of NO(sub 2) were found in homes with gas stoves than in homes with electric stoves. A sample of the homes showed that personal exposures of the infants could be estimated by room concentrations and mothers would complete a daily calendar-diary on respiratory symptoms and provide information every two weeks on illnesses occurring. In the second pilot study, we recruited 75 infants and followed them for four months. The illness surveillance system was compared with the clinical assessments by the nurse practitioner and the subjects' physicians, and with viral cultures.

49537 (PB–90-248907/XAB) **Integrated criteria document: Asbestos effects.** Slooff, W.; Blokzijl, P.J. Rijksinstituut voor Volksgezondheid en Milieuhygiene, Bilthoven (Netherlands). May 1989. 156p. (RIVM–758473013). Source: NTIS, PC A08/MF A01.

See also PB–90-248915. North American Continent sales only. All others National Institute of Public Health and Environmental Protection, P.O. Box 1, 3720 BA Bilthoven, The Netherlands.

The document contains data on asbestos concerning the sources and distribution pattern (soil, water, air), the risks to man in particular at current exposure levels, and the technical possibilities and economic consequences of reducing these risks. The information provides the scientific basis for the formulation of the effect-directed standardization policy. Since the risks remain confined to exposure via the respiratory route, the emphasis is especially on the environmental compartment air. Asbestos is the subject of much attention especially because of its effects on the health of man. The principal effect is the development of bronchial carcinomas (lung cancer) and mesotheliomas (tumors of the pleura and peritoneum) following exposure via the respiratory route. There is no evidence of a carcinogenic effect following exposure via the gastrointestinal tract. It is assumed that the current exposure level via the oral route involves a negligible risk. The carcinogenic activity of asbestos at exposure via the respiratory route depends on the shape of the fibers (length/diameter ratio of at least 3), and especially on their dimensions.

49538 (PB–90-250135/XAB) **Measurements of exhaled breath using a new portable sampling method.** Pellizzari, E.D.; Thomas, K.W.; Raymer, J.H.; Smith, D.J.; Cooper, S.D. Research Triangle Inst., Durham, NC (USA). Jul 1990. 313p. Contract EPA-68-02-4544. Source: NTIS, PC A14/MF A02.

Breath measurements offer the potential for a direct and noninvasive evaluation of human exposure to volatile organic compounds (VOCs) in the environments in which people live and work. The research study was conducted to further develop the potential of this exposure assessment methodology. A new alveolar breath measurement technique was developed and tested. Air samples were collected in 32 microenvironments and above 6 consumer products to determine a few potential sources of human exposures to selected VOCs. Elimination half-lives were estimated using a mono- and biexponential model. The alveolar breath collection and analysis methodology proved to be very useful for collecting many samples in short time intervals and this capability was very important for accurately describing the initial phase of the decay curves. Analysis of microenvironment air samples from homes, businesses, workplaces, vehicles, etc., revealed a wide range of potential sources of human exposures to VOCs at concentrations from 1 to 16,000 microg/cu m.

49539 (PB–90-250366/XAB) **Health assessment for Union Carbide Disposal/Red Oak Landfill Site, Red Oak, Iowa, Region 7. CERCLIS No. IAD980643509. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 9 Jul 1990. 10p. Source: NTIS, PC A02/MF A01.

Waste disposed of at the site from 1962 to 1974 consists of municipal refuse from area residences and businesses and industrial waste from Union Carbide Battery Production Division Plant and Uniroyal Hose Plant. Industrial wastes disposed of at the site by the Union Carbide Plant consist of organic compounds, solvents, heavy metals and other chemicals related to the production of dry cell batteries. The site is now being used for temporary storage of dismantled pipeline materials from the Northern Natural Gas Company. Soil, sediment, seepage water, and surface water samples were collected in September 1984. No samples of the actual waste material disposed of at the site were obtained during the sampling process. There were no groundwater (saturated zone) samples taken on-site. Based on the available information, this site is considered to be of potential public health concern because of the risk to human health caused by potential exposure to hazardous substances via ingestion of contaminated off-site groundwater, ingestion of contaminated on-site surface water, and incidental ingestion and inhalation of actual waste materials.

49540 (PB–90-252495/XAB) **Reactor processes in synthetic organic chemical manufacturing industry. background information for proposed standards. Draft report.** Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards. Jun 1990. 391p. (EPA–450/3-90/016A). Source: NTIS, PC A17/MF A03.

Standards of performance for the control of volatile organic compound (VOC) emissions from new, modified, and reconstructed reactor process units used in the manufacture of synthetic organic chemicals are being proposed under Section 111 of the Clean Air Act. The document contains background information on the industry and processes concerned and environmental and economic impact assessments of the regulatory alternatives considered in developing the proposed standards.

49541 (PB–90-253170/XAB) **Report of the Expert Group on Emissions Scenarios of the Response Strategies Working Group of the Intergovernmental Panel on Climate Change. Technical draft report.** Environmental Protection Agency, Washington, DC (USA). Office of Policy, Planning and Evaluation. Apr 1990. 56p. Source: NTIS, PC A04/MF A01.

See also PB–90-253188.

A report is presented of the Expert Group on Emissions Scenarios, which includes the United States and the Netherlands, from the Response Strategies Working Group of the Intergovernmental Panel on Climate Change, April 1990. Five scenarios are presented in which greenhouse gas emissions could change over the next century: High Emissions; Low Emissions; Control Policies; and Accelerated Policies (two scenarios). The scenarios also illustrate changes that might stabilize emissions and allow growth and improvement in the standard of living. Goals of 20% reduction in CO_2 emissions are considered by the early part of the next century (Toronto Conference: The Changing Atmosphere - 1988).

49542 (PB–90-253188/XAB) **Report of the Expert Group on Emissions Scenarios of the Response Strategies Working Group of the Intergovernmental Panel on Climate Change. Appendix. Technical report (Draft).** Environmental Protection Agency, Washington, DC (USA). Office of Policy, Planning and Evaluation. Apr 1990. 230p. Source: NTIS, PC A11/MF A02.

See also PB–90-253170.

The appendix contains back-up data to the five scenarios of potential climate change in greenhouse gas emissions over the next century and changes to stabilize emissions, as presented in Emissions Scenarios: Report to the Expert Group on Emissions Scenarios from the Response Strategies Working Group of the Intergovernmental Panel on Climate Change, April 1990.

49543 (PB–90-254988/XAB) **Evaluation of emission factors for formaldehyde from certain wood processing operations. Final report, May-August 1989.** White, T.S. Radian Corp., Research Triangle Park, NC (USA). Jun 1990. 33p. Contract EPA-68-02-4286. Source: NTIS, PC A03/MF A01.

See also PB–88-118492.

The report gives results of a search for information on formaldehyde emissions from wood veneer operations, to develop emission factors for the industry. Formaldehyde releases of 246 kg were reported under Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986 from a large plywood plant in Mississippi. However, existing data found during the study period were insufficient to allow reliable emission factors to be calculated.

49544 (PB–90-255662/XAB) **Air/Superfund national technical guidance study series. Development of example procedures for evaluating the air impacts of soil excavation associated with Superfund remedial actions. Final report.** Saunders, G.L. PEI Associates, Inc., Cincinnati, OH (USA). Jul 1990. 80p. Contract EPA-68-02-4394. Source: NTIS, PC A05/MF A01.

Also pub. as Radian Corp., Austin, TX. rept. no. DCN-90-203-080-61-02.

The purpose of the project was to identify and define the computation requirements or estimating the air impacts from the remediation of Superfund sites. Two example sites employing soil excavation were selected because they represent a complex emission source. The procedures for the evaluation of the ambient impacts were divided into several subtasks. These included site characterization, selection of remedial alternatives, definition of remedial activities, estimation of emission rates for each remedial activity, determination of ambient concentrations from dispersion modeling, and evaluation of carcinogenic and noncarcinogenic risks based on dispersion modeling results. The calculation of emission rates were used to estimate ambient impacts through dispersion models. The purpose was to outline a set of procedures that could be used, with existing tools, to assist in the evaluation of air-pathway effects.

49545 (PB–90-256785/XAB) **User-friendly data entry routine for the ESP model. Final report, June 1988-September 1989.** Faulkner, M.G. Southern Research Inst., Birmingham, AL (USA). Jul 1990. 84p. Source: NTIS, PC A05/MF A01.

The report is a user's manual for an interactive data entry program that greatly simplifies the creation and modification of electrostatic precipitator (ESP) model data files. Routine use of the interactive program, written for IBM PC-compatible computers, will eliminate a major source of error in computing with the EPA/Southern Research Institute ESP model, which has very exacting format requirements for the input data sets. The report describes each step necessary to create data files. Data files written using the program on a PC may be transferred to a main frame without change.

49546 (PNL–6450-34-HEDR) **Hanford Environmental Dose Reconstruction Project: Monthly report, August 1990.** Finch, S.M. (comp.). Pacific Northwest Lab., Richland, WA (USA). 1990. 42p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE90017649. Source: OSTI; GPO Dep.

The objective of the Hanford Environmental Dose Reconstruction Project is to estimate the radiation doses that populations could have received from nuclear operations at Hanford since 1944. The project is being managed and conducted by the Pacific Northwest Laboratory (PNL) under the direction of an independent Technical Steering Panel (TSP). The project is divided into the following technical tasks. These tasks correspond to the path radionuclides followed, from release to impact on humans (dose estimates): source terms; environmental transport; environmental monitoring data; demographics; agriculture; food habits; and environmental pathways and dose estimates. 3 figs.

49547 (PNL–7201) **Supplemental mathematical formulations: The Multimedia Environmental Pollutant Assessment System (MEPAS).** Droppo, J.G. Jr.; Whelan, G.; Buck, J.W.; Strenge, D.L.; Hoopes, B.L.; Walter, M.B.; Knight, R.L.; Brown, S.M. Pacific Northwest Lab., Richland, WA (USA). ©Dec 1989. 124p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-76RL01830. Source: National Energy Software Center (software packages requested by U.S. Government Agencies and their contractors), Argonne National Lab., Argonne, IL (312)972-7250) or FTS (972-7250). Other requestors should be directed to PNL.

The Multimedia Environmental Pollutant Assessment System (MEPAS) is a methodology for assessing relative health impacts from the release of hazardous chemical and radioactive materials. MEPAS is an enhanced version of the Remedial Action Priority System (RAPS). This document, a supplement to the RAPS documentation, contains an overview of MEPAS followed by detailed discussions of enhancements. MEPAS provides outputs of health impact parameters for use in ranking and screening applications. Environmental contaminant concentrations are used to estimate potential health impacts based on major exposure pathways. Enhancements to the groundwater, surface water, overland, atmospheric, and exposure components are documented. These enhancements include a revision in the integration method for the waterborne pathway, a wetland component, a gaseous emission (volatilization) component, an atmospheric complex terrain component, mass budget formulations, and environmental decay of chemical constituents. Several new exposure components are described along with enhancements to the exposure pathways computations. 18 refs., 7 figs., 5 tabs.

49548 (PNL–7216-Vol.1) **Multimedia Environmental Pollutant Assessment System (MEPAS) application guidance: Volume 1, User's guide.** Droppo, J.G. Jr.; Strenge, D.L.; Buck, J.W.; Hoopes, B.L.; Brockhaus, R.D.; Walter, M.B.; Whelan, G. Pacific Northwest Lab., Richland, WA (USA). ©Dec 1989. 129p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-76RL01830. Source: National Energy Software Center (software packages requested by U.S. Government Agencies and Their Contractors), Argonne National Lab., Argonne, IL (312-972-7250 or FTS 972-7250). Other requestors should be directed to PNL.

This is Volume 1 of a two-volume set of documents that instruct investigators in the use and application of the Multimedia Environmental Pollutant Assessment System (MEPAS). MEPAS was developed by Pacific Northwest Laboratory as a screening tool that evaluates human health impacts. It uses mathematical algorithms to simulate contaminant release, transport, and exposure. MEPAS is designed to consider both hazardous and radioactive releases from either active or inactive sizes. These two volumes explain the methodology behind the MEPAS model and instruct the user how to input, retrieve, and evaluate data. This volume is a user's guide that provides step-by-step instructions for operating MEPAS at a site. 9 refs., 18 figs., 5 tabs.

49549 (PPP-JULK–9) **Particle emissions.** Suomen Akatemja, Helsinki (Finland). 1987. 173p. (CONF-8703335–: International seminar on particle emissions, Otaniemi (Finland), 11-12 Mar 1987). Source: Suomen Akatemja, Helsinki, Finland.

The Combustion Research Cooperation Group of the Academy of Finland.

The Academy of Finland has since 1983 supported fundamental combustion research in Finland by providing funding for the cooperation between different university departments and research organizations with an interest in combustion research. The members of this combustion research group (Poltto, Palaminen,

Paeaestoet) are listed below. One of the events of this cooperation has been an annual two-day seminar for research associates in the member organizations. In these seminars both guest speakers and lecturers from the member organizations have given presentations on the topic of the seminar. The seminars have been open for research people from non-member organizations as well. The seminars have been arranged at the different member-universities by turns. This year the seminar was arranged on the March 11th-12th at Helsinki University of Technology in Otaniemi. The topic was Particle Emissions. The leading guest speaker was Prof. Richard C. Flagan from the California Institute of Technology, USA. In addition to him two invited speakers from Sweden and five from Finland gave lectures. Besides the lectures of guest speakers the seminar participants had the possibility to expose posters dealing with the seminar topic. Ten of them used this opportunity. In this report the presentations by the guest speakers are presented as received without any editorial changes. On behalf of the organizers I wish to express our thanks to all the participants and particularly to our guest speakers for the exciting and interesting seminar.

49550 (PPP-JULK–9, pp. 77-103) **Size distribution measurement of particles in flue gases.** Kauppinen, E.I. (Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Heating, Ventilation and Air Conditioning (Finland)). Helsinki Univ. of Technology, Otaniemi (Finland). Inst. of Energy Engineering; Suomen Akatemja, Helsinki (Finland). 1987. (CONF-8703335–: International seminar on particle emissions, Otaniemi (Finland), 11-12 Mar 1987). In *Particle emissions.* Order Number DE90796163. Source: Suomen Akatemja, Helsinki, Finland.

In this paper, basics of flue gas particle sampling are reviewed. Methods used to measure concentration and size distribution of particles are presented. As an example of combustion aerosol size distributions, mass and metal size distributions of coal-fired power plant emission aerosols measured with low pressure impactor are presented.

49551 (PPP-JULK–9, pp. 63-71) **Atmospheric fates of air pollutants.** Jantunen, M.J. (National Public Health Inst., Kuopio (FI)). Helsinki Univ. of Technology, Otaniemi (Finland). Inst. of Energy Engineering; Suomen Akatemja, Helsinki (Finland). 1987. (CONF-8703335–: International seminar on particle emissions, Otaniemi (Finland), 11-12 Mar 1987). In *Particle emissions.* Order Number DE90796163. Source: Suomen Akatemja, Helsinki, Finland.

In this article are explained which compounds become harmful if or when they accumulate in the atmosphere. These compounds are dusts, fine aerosols, vapors compounds of C, S, N and halogens radionuclides. In this article are also described the formation of oxidants, oxidation of gaseous pollutants, the aerosol balance of coal combustion and fate of hydrocarbons.

49552 (PPP-JULK–9, pp. 9-62) **Particle formation in combustion.** Flagan, R.C. (California Institute of Technology, Pasadena California (USA)). Helsinki Univ. of Technology, Otaniemi (Finland). Inst. of Energy Engineering; Suomen Akatemja, Helsinki (Finland). 1987. (CONF-8703335–: International seminar on particle emissions, Otaniemi (Finland), 11-12 Mar 1987). In *Particle emissions.* Order Number DE90796163. Source: Suomen Akatemja, Helsinki, Finland.

Combustion processes frequently lead to the formation of particles derived from noncombustible impurities in the fuel, incompletely burned fuel particles or droplets or from vapors generated in the flame. Combustion generated particles contribute to atmospheric pollution and degrade the performance of combustion systems through erosion, corrosion and fouling of heat transfer surfaces, fans or turbines. They also play a critical role in radiative heat transfer within the combustion chamber. The importance of the particles produced in any combustion system to any of these phenomena depends upon the particle size, morphology and chemical composition. In turn, these properties depend on the way the particles were formed. In this paper we shall explore the different ways in which particles are generated in combustion systems. The focus of this paper will be on the types of combustion systems and particles that have been most intensively studied. Through examination of these systems, some features of particle formation in other systems may be understood, but many questions will be resolved only through carefully designed experimental studies of those systems. We begin with a brief examination of the properties that make combustion particles important.

49553 (PPP-JULK–9, pp. 151-169) **Fabric filters: Filtermedia.** Andersson, L. (Nordifa, Halmstad (SE)). Helsinki Univ. of Technology, Otaniemi (Finland). Inst. of Energy Engineering; Suomen Akatemja, Helsinki (Finland). 1987. (CONF-8703335–: International seminar on particle emissions, Otaniemi (Finland), 11-12 Mar 1987). In *Particle emissions.* Order Number DE90796163. Source: Suomen Akatemja, Helsinki, Finland.

In this article are described fabric filters for dust and hot gas filtration. A fabric filter is one in which dust bearing gas is passed unidirectionally through a fabric in such a manner that the dust particles are retained on the dirty gas side of the fabric, while the clear gas passes through the fabric to the clean gas side. The fabric may be of any fibrous material - either natural or manmade and woven or impacted to a felt.

49554 (PPP-JULK–9, pp. 125-132) **Optical measuring methods.** Ruuskanen, J. (Kuopio University (FI). Dep. of Environmental Hygiene (Finland)). Helsinki Univ. of Technology, Otaniemi (Finland). Inst. of Energy Engineering; Suomen Akatemja, Helsinki (Finland). 1987. (CONF-8703335–: International seminar on particle emissions, Otaniemi (Finland), 11-12 Mar 1987). In *Particle emissions.* Order Number DE90796163. Source: Suomen Akatemja, Helsinki, Finland.

Many aerosol mass monitoring techniques have been reviewed and new prototype mass monitoring systems are being developed. Several mass monitoring systems based on light extinction are commercially available and are being applied to many various emission sources. The extinction of light by aerosol emissions has been widely used and is the most extensively developed technique for aerosol sources behaving well. The use of an optical extinction method to monitor aerosol mass concentrations is a promising concept, but its applications depends on the development of the consistent relationship between extinction of light and aerosol mass concentration. When an optical extinction measurement is used, the effective signal which indicates mass concentration is characterised by the optical thickness of the aerosol population measured. The optical thickness depends on complex refractive index of the aerosol material, particle size and shape and particle density. Thus, the optical extinction instruments as transmissometers can be only used to monitor indirectly the mass concentration of aerosol populations. The mass concentration of the aerosol population must be shown to correlate with an optical measured characteristic by using the external calibration which must be shown to hold constant for the aerosol emissions under all operating conditions. The physical characteristics of the optical thickness affecting the calibration must not change if the calibration is to ramain constant. The purpose of this presentation is to discuss about optical extinction transmissometers, their reliability and performance capability. In the last part a new multi-wavelength extinction method is described, and experimental results measured under laboratory conditions are presented for sodium sulfate aerosols.

49555 (PPP-JULK–9, pp. 135-150) **Electrostatic precipitators.** Immonen, O. (SF-Cleanair, Kaarina (FI)). Helsinki Univ. of Technology, Otaniemi (Finland). Inst. of Energy Engineering; Suomen Akatemja, Helsinki (Finland). 1987. (CONF-8703335–: International seminar on particle emissions, Otaniemi (Finland), 11-12 Mar 1987). In *Particle emissions.* Order Number DE90796163. Source: Suomen Akatemja, Helsinki, Finland.

Electrostatic precipitators (ESP) are widely used in many kind of industrial prosesses for separating dust from different gases. An ESP is an essential part of a coal or peat firing power plant. Compared to other type of dust trapping equipment (cyclones, textile filters) and ESP has several advantages: low maintainance costs (low pressure drop, low energy consumption), suitable for high temperatures (up to 500 deg C), can be designed for large gas amounts and high collecting efficiencies, long service life. On the other hand, compared to other equipment, an ESP has quite high investment costs, especially for small units and when especially low emissions (under 50 mg/Nm^3) are needed.

49556 (PPP-JULK–9, pp. 107-121) **The theory and technics of particle measuring methods: Controlling measurements. Dust.** Aittola, J.P. (Valtion Teknillinen Tutkimuskeskus, Jyvaeskylae (Finland). Kotimaisten Polttoaineiden Lab. (Finland)). Helsinki Univ. of Technology, Otaniemi (Finland). Inst. of Energy Engineering; Suomen Akatemja, Helsinki (Finland). 1987. (CONF-8703335–: International seminar on particle emissions, Otaniemi (Finland), 11-12 Mar 1987). In *Particle emissions*. Order Number DE90796163. Source: Suomen Akatemja, Helsinki, Finland.

In energy production, different kinds of controlling measurements are used to obtain data from the combustion process and combustion products. The impurities which occur in the fuel or are formed during combustion are transferred to the outward flows of ash, fly ash and flue gas within the space of a few minutes. Gaseous and solid substances are carried with the fuel gases via the purification equipment and the stack into the atmosphere. The emission from inciveration can be divided roughly into emissions of substances which occur in the fuel (such as metals, sulphur, chlorine...) and emissions of substances formed in the plant during its operation (such as organic compound). The dust in the flue gas occupies an intermediate position. Partly its nature is depending on the fuel used partly on the combustion process and equipment. Historically, the dust has been grouped with the substances that depend on the fuel (coal, waste, oil, peat...), since the requirements for dust removal and need for controlling measurements have been partly governed by the metal coatcut of the dust. However, lately the dust concentration in off gases has become a critical parameter and has been regulated quite strictly (for example in Finland, Appendix 1) on the basis of the fuel incinerated (coal, oil, indigenous, waste...) and the size of the boiler (fuel energy (MW)). In this respect the incineration plants are nowadays equipped with effective arrangements for the removal of dust. Usually the plants are equipped with cyclones, multicyclones and ESP's. A large number of new plants are also equipped with textile fabric filters.

49557 (WHC-SA–0483) **Simulation of alpha continuous air monitor alarm response in the presence of plutonium.** Brown, R.C. (Westinghouse Hanford Co., Richland, WA (USA)); Fleming, D.M.; Nichols, L.L. Westinghouse Hanford Co., Richland, WA (USA). Jul 1989. 35p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-87RL10930. (CONF-8907215–1: Health physics society annual meeting, Albuquerque, NM (USA), Jul 1989). Order Number DE90017727. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The presence of radon and thoron daughters causes interference in the plutonium channel of alpha continuous air monitors used to detect airborne plutonium. Single-channel alpha energy spectroscopy is used to minimize this effect, and additional compensation is provided by electronically subtracting a constant fraction of the count rate appearing in the higher energy "radon window" from the count rate appearing in the plutonium window. The standard deviation of the resulting net count rate is nonzero. The probability of falsely reporting the presence of plutonium when in fact none is present (Type I error) is influenced by this nonzero standard deviation and becomes unacceptably high if the alarm setpoint is too low. These conditions were used to simulate the response of an alpha continuous air monitors to radon interference using a Monte Carlo simulation. Radon and thoron daughter concentrations measured during a one-week period were used. These measurements indicated the diurnal variations of over two decades in radon and thoron daughter response as well as a longer ingrowth of ^{212}Pb and subsequent daughter transitions were present. The response of the logarithmic count rate meter was also simulated to preserve the normally observed fluctuations. The simulations include response of the alpha CAM with the observed radon and thoron daughter contributions with and without plutonium present. Information obtained included the following as a function of alarm setpoint: number of Type I alarms and the time required to provide a true alarm after initiation of simulated plutonium releases. 3 refs., 8 figs., 1 tab.

49558 **Real-time vapor monitoring with MS/MS.** Glish, G.L. (Oak Ridge National Laboratory, TN (USA)); McLuckey, S.A.; Asano, K.A. pp. 14, Paper ANYL 45 of American Chemical Society, Division of Analytical Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

Air monitoring using mass spectrometry has usually meant using some form of atmospheric pressure ionization (API) with a quadrupole mass spectrometer. Conventional API sources (beta emitters or corona discharges) have several drawbacks. We have recently described a new ionization source that directly samples ambient air and overcomes the problems listed above. This source has now been interfaced to an ion trap mass spectrometer (ITMS). In this talk the new ionization source will be briefly reviewed, and the interfacing of it to the ITMS and the advantages of using an ITMS versus a quadrupole will be discussed. Performance characteristics of the system will be presented and data from various types of compounds, using both negative and positive ions, will be shown.

49559 **Problems in aircraft measurement of trace atmospheric species.** Daum, P.H. (Brookhaven National Laboratory, Upton, NY (USA)). pp. 43, Paper ANYL 144 of American Chemical Society, Division of Analytical Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

Measurement of trace atmospheric species from aircraft imposes requirements on instrumentation and sampling techniques that are much more demanding than for equivalent surface based measurements. These enhanced requirements arise from the speed and altitude range over which aircraft measurements are typically made. For collection of integrated samples of aerosol, cloudwater, and precipitation from aircraft, the principal difficulty is defining the particle size range of the sample, and collecting the sample in a way that does not alter its composition. For aerosol, this is usually achieved by use of isokinetic inlets. For cloudwater and precipitation samples where phase changes during sampling may occur, and for which size distributed information may be required, the problems are much more difficult, and are not completely resolved.

49560 **The solubility and free energy of formation at 30°C of dehydrated schoepite, $UO_3 \cdot 0.9H_2O$.** Nguyen, Son N. (Lawrence Livermore National Laboratory, CA (USA)); Weed, H.C.; Andrews, J.E. Jr.; Silva, R.J. pp. 91, Paper INOR 317 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

Information on the solubility of uranium compounds is indispensable for elucidating migration mechanisms of uranium in the biosphere. In this study, an uranium trioxide hydrate, $UO_3 \cdot xH_2O$ ($x < 1$) was synthesized. The X-ray powder diffraction pattern, infrared spectrum, as well as chemical and thermal analyses of the synthetic material identified it as a new form of dehydrated schoepite, whose chemical formula corresponds to $UO_3 \cdot 0.9H_2O$. The solubility product constant for this dehydrated schoepite was determined via its solubility study at 30°C by Lawrence Livermore National Laboratory in support of the Yucca Mountain project. The free energy of formation of this synthetic mineral is calculated and compared to that obtained by the solution-calorimetric measurement.

49561 **Advantages of a modular design approach for radiological instrumentation.** Bryan, W.L. (Oak Ridge National Lab., TN (USA). Instrumentation and Controls Div.); Maddox, S.R.; Ericson, M.N.; Britton, C.L.; Emery, M.S.; Alley, G.T. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA)*, 37(2): 873-877 (Apr 1990). DOE Contract AC05-84OR21400. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The application of a modular design approach to the development and implementation of radiological instrumentation provides significant improvements over conventional instrument design in terms of capability, maintainability, and overall system cost. Two implementations utilizing this approach are discussed: a multifunction survey meter system developed for the U.S. Navy RADIAC program, and a stationary workplace monitoring system under development for

use at Oak Ridge National Laboratory (ORNL). By designing modular, functionally partitioned hardware and software subsystems incorporating standard interfaces, it is possible to generate whole families of instrumentation systems in a building block fashion.

49562 An overview of instrumentation for measuring environmental radon and radon progeny. George, A.C. (Environmental Measurements Lab., USDOE, New York, NY (US)). *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 892-901 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

Instruments for the measurement of radon and its progeny are based mostly on the detection of alpha particles and to some extent on the detection of beta and gamma emissions. This paper discusses how the instruments and methods used depend on whether the technique measures radon or radon progeny, the type of radiation being detected and the duration of the measurement of which there are three types: grab or instantaneous, integrating and continuous. Other criteria used in the design of these instruments are field measurement applicability, portability, convenience, reliability and cost. With the recent increased demand for indoor radon and radon progeny measurements, instrument development has focused on the design of inexpensive mailable devices for short-term exposures used in screening studies, as well as on more complex and sophisticated instruments for both short-term and long-term measurements used in research programs.

49563 New method permits the detection of alpha emitters at a distance. Wolf, M.A. (Los Alamos National Lab., NM (USA)); McAtee, J.L.; Unruh, W.P. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 883-884 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

This paper describes a method that permits the detection of alpha emitting materials, such as plutonium, at substantial distances. This method may permit the development of new instruments for monitoring equipment and personnel at entrances to facilities where alpha emitting contaminants are potential hazard. The technique uses detection of the secondary effects of alpha particles interacting in air (production of ions) to detect their presence. This technique is simple and requires no expensive equipment or exotic detectors. It is applicable to rapid automatic monitoring of personnel or equipment exiting hazardous areas.

49564 A more rugged ZnS(Ag) alpha scintillation detector. McElhaney, S.A. (Oak Ridge National Lab., TN (USA)); Ramsey, J.A.; Bauer, M.L.; Chiles, M.M. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 868-872 (Apr 1990). DOE Contract AC05-84OR21400. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

Conventional alpha scintillation detectors comprise a phosphor-coated light-pipe covered by a thin aluminized Mylar layer. This opaque radiation entrance window serves as a shield against ambient light entering the detector with minimum alpha attenuation. Unfortunately, Mylar is extremely fragile and easily punctured or torn by sticks, stones, and screws encountered during regular radiation surveys. The authors have been developing an alpha scintillation detector more rugged and durable than conventional models. This paper presents the scintillator assembly, which consists of a mixture of silver-activated zinc sulfide [ZnS(Ag)] and clear epoxy. The ZnS(Ag) scintillation powder is mixed with a low-viscosity, optically transparent epoxy and poured into a glass-smooth mold of desired shape and size.

5402 Environmental Sciences, Terrestrial

Refer also to citation(s) 48098, 48099, 48103, 48149, 48151, 48156, 48183, 48256, 48268, 48272, 48275, 48276, 48305, 48306, 48372, 48413, 48702, 49417, 49456, 49474, 49475, 49476, 49477, 49478, 49479, 49480, 49481, 49482, 49483, 49484, 49485, 49486, 49487, 49488, 49489, 49490, 49491, 49492, 49493, 49494, 49495, 49496, 49497, 49498, 49499, 49500, 49501, 49502, 49503, 49504, 49505, 49506, 49507, 49508, 49509, 49510, 49511, 49512, 49513, 49514, 49515, 49516, 49517, 49518, 49519, 49520, 49521, 49522, 49523, 49524, 49525, 49526, 49527, 49528, 49529, 49530, 49533, 49534, 49535, 49537, 49539, 49544, 49546, 49547, 49548, 49603, 49606, 49607, 49608, 49609, 49611, 49614, 49615, 49616, 49617, 49619, 49620, 49623, 49624, 49625, 49626, 49627, 49629, 49630, 49631, 49632, 49734

49565 (ANL/APS/TM–7) **Synchrotron x-ray sources and new opportunities in the soil and environmental sciences: Workshop report.** Schulze, D. (Purdue Univ., Lafayette, IN (USA)); Anderson, S.; Mattigod, S. Argonne National Lab., IL (USA). Advanced Photon Source Div. Jul 1990. 125p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-900190–: Synchrotron x-ray sources and new opportunities in the soil and environmental sciences: workshop report, Argonne, IL (USA), 8-10 Jan 1990). Order Number DE90018002. Source: NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

This report contains the following papers: characteristics of the advanced photon source and comparison with existing synchrotron facilities; x-ray absorption spectroscopy: EXAFS and XANES – A versatile tool to study the atomic and electronic structure of materials; applications of x-ray spectroscopy and anomalous scattering experiments in the soil and environmental sciences; X-ray fluorescence microprobe and microtomography.

49566 (CONF-9009251–1) **Performance evaluation of a groundwater and soil gas remedial action.** Hansen, M.C.; Hartnett, S.L. Argonne National Lab., IL (USA). Jul 1990. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 13. annual Madison waste conference; Madison, WI (USA); 19-20 Sep 1990. Order Number DE90017659. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Volatile organic compounds (VOCs) continue to be remediated by a groundwater extraction system and an in-situ vapor extraction system at a Midwest agricultural site. Carbon tetrachloride (CCl_4) and chloroform ($CHCl_3$) contamination levels were detected at maximum concentrations of 4000 parts per billion (ppb) and 360 ppb, respectively, for on-site groundwater samples and 6000 ppb and 1800 ppb, respectively, for on-site gas samples. Groundwater from a domestic well and a monitoring well located at least 2300 ft. downgradient from the site also had CCl_4 and $CHCl_3$ contamination. Furthermore, a public water supply well, located downgradient of the site, was found to have groundwater contaminated with CCl_4. During two years of operation of the remedial action, groundwater and soil gas samples have been analyzed to monitor potential migration of contaminants from the site and to track the overall progress toward cleanup. Results demonstrate a decrease in groundwater contamination in both on- and off-site monitoring wells and a decrease in soil gas air emissions from the site. This paper presents the sampling results for the site over the last two years and discusses trends indicating the effectiveness of the remedial action system in controlling contaminant migration and overall progress toward reducing the source of contamination in the unsaturated subsoils. 7 refs., 3 figs., 3 tabs.

49567 (CONF-9010191–1) **Reuse of incinerated soil residues in land reclamation.** Johnson, D.; Van Dyke, G.; Miller, R.; Jastrow, J. Argonne National Lab., IL (USA). May 1990. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 10. world fertilizer congress of CIEC; Nicosia (Cyprus); 21-27 Oct 1990. Order Number DE90017687. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Incineration (thermal destruction) is increasingly seen as a feasible cleanup process for soils contaminated by organic hazardous wastes. Incineration frees those responsible for cleanup from landfilling large volumes of materials and provides a permanent solution by destroying wastes rather than placing them in long-term storage. This paper reports on an investigation of the pot-culture responses of plants to the unique characteristics of ashes produced by incinerating soils contaminated by hazardous waste in mobile rotary kilns. The results provide valuable background information for field tests of revegetative strategies. Longer-term project

objectives are to provide economical alternatives to elaborate disposal methods, and to assure better results than the limited and weekly plant cover achieved at the Lenz site. 13 refs., 4 tabs.

49568 (DOE/OR/00033–T439) **Differential seeding and regeneration in openings and beneath closed canopy in subtropical wet forest.** Devoe, N.N. Yale Univ., New Haven, CT (USA). ©1989. 307p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-76OR00033. Source: Yale University, New Haven, CT.

Two experiments were performed in sub-tropical wet forest (tabonuco (Dacryodes excelsa) type) at El Verde, Puerto Rico. The first compared seed rain beneath closed canopy with that in natural treefall gaps. The purpose was to determine whether differences in seed rain might account for some part of the reported difference in tree regeneration under the two canopy conditions. The second experiment examined regeneration along transects from beneath the forest canopy across large gaps. Plant colonization patterns clearly showed that gaps are non-uniform environments. The correlation of certain attributes (seed weight, dispersal mode, regeneration route, shade tolerance) within species and among groups of species led to the description of regeneration strategies for species in this and similar forest communities. Silvicultural applications are discussed. 33 figs., 33 tabs.

49569 (FWS/OBS–82/15) **Texas Barrier Islands Region ecological characterization atlas: Socioeconomic and natural features narrative.** Kimber, C.T. (Texas A and M Univ., College Station, TX (USA)); White, K.L.; Hendricks, F.S. National Coastal Ecosystems Team, Washington, DC (USA); Texas A and M Univ., College Station, TX (USA). Feb 1984. 73p. Sponsored by U.S. Department of the Interior. (MMS–84-0005). Source: OSTI; U.S. Fish and Wildlife Service, NASA-Slidell Computer Complex, 2020 Gause Blvd., Slidell, LA 70458.

The study area for the Texas Barrier Islands Region Ecological Characterization Atlas extends from the eastern end of East Bay, Texas to the Texas-Mexico border. The offshore boundary is the state-federal demarcation line, and the inland boundary is approximately 40 miles inland, including, among others, the coastal counties of Chambers, Galveston, Brazoria, Matagorda, Calhoun, Aransas, Refugio, San Patricio, Nueces, Kleberg, Kenedy, Willacy, and Cameron. Three sets of maps were produced to display information that will assist land-use planners and coastal decision makers. The three maps are Socioeconomic and Natural Features, Mineral Resources and Selected Oil and Gas Infrastructures, and Biological Resources. This text addresses the map of "Socioeconomic and Natural Features," which is composed of 1:100,000 base map overlays. 120 refs., 2 figs., 1 tab.

49570 (FWS/OBS–82/16) **Texas Barrier Islands Region ecological characterization atlas: Biological resources narrative.** Johnston, J.B. (comp.) (Fish and Wildlife Service, Slidell, LA (USA). National Coastal Ecosystems Team). National Coastal Ecosystems Team, Washington, DC (USA); Fish and Wildlife Service, Slidell, LA (USA). National Coastal Ecosystems Team. Feb 1984. 12p. Sponsored by U.S. Department of the Interior. (MMS–84-0005). Source: OSTI; U.S. Fish and Wildlife Service, NASA-Slidell Computer Complex, 1010 Gause Blvd., Slidell, LA 70458.

The study area for the Texas Barrier Islands Region Ecological Characterization Atlas extends from the eastern end of East Bay, Texas, to the Texas-Mexico border. The offshore boundary is the state-federal demarcation line, and the inland boundary is about 65 km (40 mi) inland, including, among others, the coastal counties of Chambers, Galveston, Brazoria, Matagorda, Calhoun, Aransas, Refugio, San Patricio, Nueces, Kleberg, Kenedy, Willacy, and Cameron. Three sets of maps were produced to display information that will assist land-use planners and coastal decision-makers. The three maps are Socioeconomic and Natural Features, Mineral Resources and Selected Oil and Gas Infrastructures, and Biological Resources. This narrative addresses the map of "Biological Resources," which is composed of 1:100,000 base map overlays. 11 refs., 1 fig., 1 tab.

49571 (FWS/OBS–82/46) **Ecological characterization atlas of coastal Alabama: Map narrative.** Smith, M.F. Jr. (ed.) (Soils Systems, Inc., Marietta, GA (USA)). National Coastal Ecosystems Team, Washington, DC (USA); Soils Systems, Inc., Marietta, GA (USA). Aug 1984. 190p. Sponsored by U.S. Department of the Interior. (MMS–84-0052). Source: OSTI; US Fish and Wildlife Service, NASA-Slidell Computer Complex, 1010 Gause Blvd., Slidell, LA 70458.

The southwest Alabama coastal region is the study area of this narrative and accompanying maps. The offshore area includes the region from the State-Federal demarcation to the shoreline, and the inland area includes Mobile and Baldwin Counties. These counties are included in the following six US Geological Survey 1:100,000-scale topographic maps: Citronelle, Atmore, Mobile, Bay Minette, Biloxi, and Pensacola. The data in this atlas meet all cartographic and narrative specifications of the Minerals Management Service and the US Fish and Wildlife Service and should be useful for coastal decisionmakers. The topics included within this map narrative are biological resources; socioeconomic features; soils and landforms; oil, gas, and mineral resources; and hydrology and climatology. 21 figs., 52 tabs.

49572 (JAERI-M–90-065) **Evaluation of water flow velocity, dispersion length and retardation factor in radionuclide migration test using undisturbed samples of aerated sandy soil layer.** Ogawa, Hiromichi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Mukai, Masayuki; Ohnuki, Toshihiko; Yamamoto, Tadatoshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 14p. (In Japanese). Order Number DE90520224. Source: NTIS (US Sales Only), PC A03/MF A01.

The water flow velocity, dispersion length and retardation factor were determined from the result of the migration tests using the soil layer samples which were collected from a natural aerated sandy soil layer without any disturbance. Each value was compared with that estimated from the soil characteristics and the experimental conditions. Though the values of dispersion length in the tests were nearly the same as those estimated from the soil characteristics, the values of water flow velocity in the tests were slightly larger than those estimated from the soil characteristics and the experimental conditions. Though the values of the retardation factor of ^{137}Cs were nearly the same as those estimated from the soil characteristics, the values for ^{60}Co and ^{85}Sr were several time or even scores of times larger than those estimated from the soil characteristics. (author).

49573 (OH/RD–89-55-K) **Prediction of the environmental fate of pentachlorophenol as a function of pH using fugacity models.** Mortimer, W.P. Ontario Hydro, Toronto, ON (Canada). Research Div. 22 Dec 1989. 14p. (MICROLOG–90-03999). Source: PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

Fugacity models are used for ranking pollutants in order to examine their environmental fate. Fugacity has units of pressure and can be regarded as the 'escaping tendency' of a chemical. Fugacity models are based on the concept that differences in the fugacity of a chemical species between environmental compartments drive the transport of the chemical from compartments of high fugacity to those of low fugacity until equilibrium is reached. For Level I calculations, the conditions are those of equilibrium, steady-state, and no flow. For Level II, the additional conditions considered are advection, photodegradation, and biodegradation within the system. In this study, Level I and II fugacity models are applied to pentachlorophenol (PCP), the major wood pole preservative used by Canadian utility companies. The preservative tends to migrate down the poles over time, and out into the surrounding soil, where it kills the organisms that cause decay in the wood. The properties of PCP used in fugacity models are described with reference to Canadian conditions, and the fugacity models are used to show that the ultimate environmental fate of PCP is pH-dependent. The parameters of environmental transport, environmental persistence, and bioccumulation are ranked and it is seen that PCP is more of a hazard under low-pH conditions. 19 refs., 3 figs., 2 tabs.

49574 (ORNL/FTR–3739) **[International meeting of ecology]: Foreign trip report, August 20, 1990–August 30, 1990.** Bowman, K.O. Oak Ridge National Lab., TN (USA). 14 Sep 1990.

3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90017627. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report, dated September 14, 1990, covers the trip to Japan of Dr. Kimiko O. Bowman, Senior Research Member in the Mathematical Sciences Section. Engineering Physics and Mathematics Division, Oak Ridge National Laboratory. The trip was supported by the Center for Indoor Air Research (CIAR). The purpose of the trip was to attend and present an invited talk at the Fifth International Congress of Ecology held at the Yokohama Prince Hotel in Yokohama, Kanagawa Prefecture, Japan, August 23–30, 1990. The presented talk "Testing the Mutagenicity of Components" described two papers on research conducted under contract to the CIAR. The only other site visited was Tokyo Science University by invitation of Dr. T. Okuno,Provost of the University. The main activities consisted of attending the meeting, contributing to the discussion, and presenting an invited talk at the conference. The discussion with Dr. Okuno was on general biometric research topics. The main benefit was to gain greater international exposure for our work and to discover new applications for it.

49575 (ORNL/RASA–89/10) **Results of the radiological survey at the Granite City Steel facility, Granite City, Illinois.** Swaja, R.E.; Cottrell, W.D. Oak Ridge National Lab., TN (USA). Jul 1990. 30p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90017844. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

In the late 1950s and early 1960s, uranium ingots were x-rayed for the Atomic Energy Commission at the South Plant facility of the Granite City Steel Company, Granite City, Illinois. The x-ray equipment is still housed in a building on the southern end of the property. At the time of the survey, neither the equipment nor the building had been used for some time. It is the policy of the US Department of Energy (DOE) to verify that such sites are in compliance with current federal guidelines. Because documentation establishing the current radiological condition of the property is unavailable, a radiological survey was conducted by members of the Measurement Applications and Development Group of the Oak Ridge National Laboratory in March 1989. The survey included: measurement of gamma exposure rates both indoors and outdoors; collection and radionuclide analysis of soil and debris samples; and measurements to determine alpha and beta-gamma surface contamination. 3 refs., 12 figs., 3 tabs.

49576 (OWMC–1887-01) **Report of the PCB Working Group.** Ontario Waste Management Corporation, Toronto, ON (Canada); Dillon (M.M.) Ltd., Ottawa, ON (Canada). Jan 1989. 77p. (MICROLOG–90-02857). Source: PC Ontario Waste Management Corporation, 2 Bloor St. West, 11th. Fl., Communications Service, Toronto, ON, CAN M4W 3E2; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The Ontario Waste Management Corporation's (OWMC) Working Group report identifies the quantities of polychlorinated biphenyl (PCB) waste that are likely to be treated by OWMC, and assesses any technologies or modifications to the proposed facility design that would be required to accomodate all PCB wastes. A table of the annual quantities of PCBs that are expected to go to OWMC is provided. Rotary kiln incineration is the proposed technolgy for the destruction of PCB wastes. For materials that cannot be fed to the rotary kiln, thermal volatilization and solvent extraction are proposed. The off-gases from the thermal volatilization will be incinerated in the secondary combustion chamber, and the contaminated solvent will be fed to the rotary kiln. 2 figs., 14 tabs.

49577 (PB–90-234485/XAB) **Final response to BDAT related comments document. Volume 1A-1. General BDAT issues.** Rosengrant, L.; Craig, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 226p. (EPA–530/SW-90/061A). Source: NTIS, PC A11/MF A02.

See also Volume 1, A-2, PB–90-234493; Also available in set of 19 reports PC E99/MF E99, PB–90-234477.

The response to comments document only addressed those comments which were submitted on the proposed land disposal restrictions for those waste codes and general BDAT technologies and issues which related to Third Third Wastes Treatment Standards. The commenters presented in the document are grouped according to major concerns of the commenters.

49578 (PB–90-234683/XAB) **Background document for Third Third wastes to support 40 CFR part 268 land-disposal restrictions. Final rule. Third Third waste volumes, characteristics, and required and available treatment capacity. Volume 1. Executive summary. Chapter 1 and Chapter 2.** Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 133p. (EPA–530/SW-90/062A). Source: NTIS, PC A07/MF A01.

See also Volume 2, PB–90-234691. Also available in set of 4 reports PC E99/MF E99, PB–90-234675.

The document presents the estimates of the quantities of wastes that will require alternative treatment and recovery prior to land disposal.

49579 (PB–90-234691/XAB) **Background document for Third Third wastes to support 40 CFR part 268 land-disposal restrictions. Final rule. Third Third waste volumes, characteristics, and required and available treatment capacity. Volume 2. Chapter 3.** Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 447p. (EPA–530/SW-90/062B). Source: NTIS, PC A19/MF A03.

See also Volume 1, PB–90-234683 and Volume 3, PB–90-234709. Also available in set of 4 reports PC E99/MF E99, PB–90-234675.

The section presents the results of the analyses of required capacity for each alternative technology on a waste code-specific basis for the wastes in the final Third Third rule.

49580 (PB–90-249566/XAB) **Delegation of remedy selection to regions. Directive (Final).** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 24 Mar 1986. 7p. (EPA–9260.1-09). Source: NTIS, PC A02/MF A01.

The directive presents revisions to the Record of Decision (ROD) delegation procedures designed to streamline the process of delegation of remedy selections to the Regions, and to achieve the FY '86 target of Regional Administrator signature on 90% of all selection of remedy documents.

49581 (PB–90-249582/XAB) **Redelegation of authority under CERCLA and SARA. Directive (Final).** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 25 May 1988. 44p. (EPA–9260.5-01). Source: NTIS, PC A03/MF A01.

The directive presents a complete set of new and revised redelegations of authority regarding activities under CERCLA and SARA. Published under the signature of the AA/SWER, it is the current and definitive delegations document for these authorities. Attachment A contains redelegations of authority to take specific actions. Attachment B designates responsibilities to exercise concurrence, consult, or receive notice.

49582 (PB–90-253691/XAB) **Health assessment for Abex Corporation, Portsmouth, Elizabeth County, Virginia, Region 3. CERCLIS No. VAD980551683. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 24 Jul 1990. 12p. Source: NTIS, PC A03/MF A01.

The Abex Corporation site is a former brass and bronze foundry located between Green and Washington Streets at Randolf Street, in an urban area of Portsmouth, Virginia. An alley separates the site into two sections. A fenced section to the north, the location of the former casting sands disposal area, has apartments on two sides. The southern section consisted of the office, shop, warehouse, and furnaces. Although other metals were detected, the contaminant of concern is lead. Lead was detected throughout the site, with the highest concentrations found in the casting sands. Elevated concentrations of soil lead were detected in and around the site with contamination extending into the housing areas bordering the site. The apartments closest to the site were within 30 to 40 feet of the disposal area. The site is of potential public health concern because of the potential for exposure to lead through soil ingestion and inhalation.

49583 (PNL–7216-Vol.2) **Multimedia Environmental Pollutant Assessment System (MEPAS) application guidance: Volume 2, Guidelines for evaluating MEPAS input parameters.** Droppo, J.G. Jr.; Strenge, D.L.; Buck, J.W.; Hoopes, B.L.; Brockhaus, R.D.; Walter, M.B.; Whelan, G. Pacific Northwest Lab., Richland, WA (USA). ©Dec 1989. 265p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-76RL01830. Source: National Energy Software Center (software packages requested by US Government Agencies and their Contractors), Argonne National Lab., Argonne, IL (312-972-7250 or FTS 972-7250). Other requestors should be directed to PNL.

This is Volume 2 of a two-volume set of documents that instructs investigators in the use and application of the Multimedia Environmental Pollutant Assessment System (MEPAS). MEPAS was developed as a screening tool that evaluates human health impacts. It uses mathematical algorithms to simulate contaminant release, transport, and exposure. MEPAS is designed to consider both hazardous and radioactive releases from either active or inactive sites. These volumes explain the methodology behind the MEPAS model and instruct the user how to input, retrieve, and evaluate data. This volume gives guidelines for evaluating the input parameters required to conduct an analysis with MEPAS. Volume 1 is a user's guide that provides step-by-step instructions for operating MEPAS at a site.

49584 (PNL–7435) **Soil erosion rates from mixed soil and gravel surfaces in a wind tunnel.** Ligotke, M.W.; Klopfer, D.C. Pacific Northwest Lab., Richland, WA (USA). Aug 1990. 119p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE90018008. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Protective barriers have been identified as integral components of plans to isolate defense waste on the Hanford Site. The use of natural materials to construct protective barriers over waste site is being considered. Design requirements for protective barriers include preventing exposure of buried waste, and restricting penetration or percolation of surface waters through the waste zone. Studies were initiated to evaluate the effects of wind erosion on candidate protective barrier surfaces. A wind tunnel was used to provide controlled erosive stresses and to investigate the erosive effects of wind forces on proposed surface layers for protective barriers. Mixed soil and gravel surfaces were prepared and tested for resistance to wind erosion at the Pacific Northwest Laboratory Aerosol Wind Tunnel Research Facility. These tests were performed to investigate surface deflation caused by suspension of soil from various surface layer configurations and to provide a comparison of the relative resistance of the different surfaces to wind erosion. Planning, testing, and analyzing phases of this wind erosion project were coordinated with other tasks supporting the development of protective barriers. These tasks include climate-change predictions, field studies and modeling efforts. This report provides results of measurements of deflation caused by wind forces over level surfaces. Section 2.0 reviews surface layer characteristics and previous relevant studies on wind erosion, describes effects of erosion, and discusses wind tunnel modeling. Materials and methods of the wind tunnel tests are discussed in Section 3.0. Results and discussion are presented in Section 4.0, and conclusions and recommendations Section 5.0. 53 refs., 29 figs., 7 tabs.

49585 (RRTAC–89-2-Vol.1, pp. 383-392) **A technical and economic evaluation of sulphur basepad recovery and reclamation.** England, S.L. (Mobil Oil Canada, Calgary, AB (Canada)); Leggett, S.A. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-31 Aug 1989; MICROLOG–90-03281). In *Proceedings of the conference Reclamation, a global perspective: Volume 1.* Source: PC Alberta Queen's Printer, Publications Office, 11510 Kingsway Ave, Edmonton, AB, CAN T5G 2Y5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

Alberta produces 95% of Canada's elemental sulfur by converting the H_2S present in sour oil and gas. Most of the sour gas plants built 1950-1970 stored elemental sulfur by pouring molten sulfur into a large block on top of a basepad that was also formed with molten sulfur. Many of these basepads were poured directly on soil, with minimal ground preparation. About 10% of the total sulfur inventory in Alberta consists of basepad material. Recovery of this material has been ongoing in Alberta since the early 1980's. A variety of techniques that rely on various degrees of off-site disposal have been used extensively. Recovery techniques range from extensive use of landfills for disposal of sulphur contaminated material to attempts to neutralize and reclaim the material on site. The problems and costs of site reclamation vary depending on site location, conditions, and basepad recovery techniques. While the location and condition of the sites are fixed variables, choices of recovery techniques can influence the success of reclamation programs. The techniques used for recovery and reclamation to date are reviewed along with the problems and costs associated with each. Case histories of reclamation work undertaken by Mobil Oil Canada are also presented. 7 refs., 3 tabs.

49586 (WAU/CGS–CE03140, pp. 223-231) **Assessment of the organics containment plume at Ville-Mercier, Quebec, Canada.** Locat, J. (Univ. Laval, Ste-Foy, PQ (Canada)); Gelinas, P.; Isabel, D.; Roy, C.; Rouleau, A. Canadian Geotechnical Society, Waterloo, ON (Canada). 1989. (CONF-891015–: 42. Canadian geotechnical conference, Winnipeg (Canada), 23-25 Oct 1989; CE–03140). In *Materials: From theory to practice: Proceedings.* Source: Canadian Geotechnical Society, University of Waterloo, Waterloo, ON, CAN . Prices: PRICES UPON REQUEST.

The Ville-Mercier Site has been recognized as one of the most important cases in Canada of groundwater contamination with organic compounds. Most of the contaminants come from used oil and refinery sludges but also include chlorinated hydrocarons, acids and alkalis, mercaptans, polymers, insecticides, pesticides, solvents, paint residues and other undefined organic residues. Approximately 40,000 m^3 of industrial waste products were disposed at the site (a gravel pit in glacio-fluvial sediments) from 1968 to 1972. The contamination of more than 30 km^2 of the underlying aquifer resulted. In 1985, a treatment plant started a decontamination program aimed at both trapping the water to prevent any more extension of the contaminant plume and to clean the extracted waste water. A recent investigation of the site has been initiated to evaluate the performance of the decontamination system. The methodology used to assess the contaminant plume (geophysic, drilling, soil and rock sampling, site instrumentation and in situ testing) is described as well as the first results pertaining to the extent of the contamination plume, particularily near the pumping wells. A complex stratigraphic environment has been demonstrated, from very bouldery to silty sediments, overlying a fractured bedrock in which a strong local upward gradient was observed. The contaminants are very diversified, light or heavy, miscible or immiscible and thus the plume is very irregular. The heavy liquids have reached the bedrock aquifer and have already moved in pockets as far as 300 m away from the initial lagoon. The preliminary results reveal that other strategies will have to be implemented if a satisfying decontamination is to be achieved. 10 refs., 9 figs. 1 tab.

5403 Environmental Sciences, Aquatic

Refer also to citation(s) 48099, 48151, 48157, 48158, 48162, 48170, 48171, 48271, 48273, 48280, 48282, 48287, 48310, 48372, 48516, 49194, 49417, 49456, 49459, 49474, 49475, 49476, 49477, 49478, 49479, 49480, 49481, 49482, 49483, 49484, 49485, 49486, 49487, 49488, 49489, 49490, 49491, 49492, 49493, 49494, 49495, 49496, 49497, 49498, 49499, 49500, 49501, 49502, 49503, 49504, 49505, 49506, 49507, 49508, 49509, 49510, 49511, 49512, 49513, 49514, 49515, 49516, 49517, 49518, 49519, 49520, 49521, 49522, 49523, 49524, 49525, 49526, 49527, 49528, 49529, 49530, 49533, 49534, 49535, 49537, 49539, 49546, 49547, 49548, 49566, 49570, 49571, 49574, 49576, 49577, 49579, 49583, 49734, 49737, 49741

49587 (AD-A–223136/3/XAB) **General design memorandum, Gulfport Harbor, Mississippi. Design Memorandum Number 1. Appendix E. Thin-layer disposal. Final report.** Rees, S.I. Corps of Engineers, Mobile, AL (USA). Mobile Coastal Section. Jun 1989. 302p. (COESAM/PDFC–89/08). Source: NTIS, PC A14/MF A02.

Appendix E to AD-A223 132. See also Appendix F, AD-A223 137. Original contains color plates: All DTIC reproductions will be in black and white.

This report presents the results of a one year monitoring program of the impacts associated with the thin-layer disposal of 50,000 cubic yards of new work dredged material in Mississippi Sound. The object of thin-layer disposal is two fold: (1) the placement of dredged material in open water in a layer 12 inches thick or less and (2) reduction of short term impacts to the aquatic ecosystem. Results of this monitoring program indicate that: (1) It is possible to control lift-thickness during open water disposal. (2) Recovery of benthos following a December disposal operation begins as early as 6-weeks post disposal abundances within the disposal area are similar to non-disposal areas. (3) Recruitment to the disposal area, following the December disposal, was mediated by adult migration, followed by spring larval settlement.

49588 (BR–82(11.118)) **Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): Striped bass.** Hill, J. (Georgia Univ., Athens, GA (USA). School of Forest Resources); Evans, J.W.; Van Den Avyle, M.J. Army Engineer Waterways Experiment Station, Vicksburg, MS (USA); Georgia Univ., Athens, GA (USA). School of Forest Resources; Georgia Univ., Athens, GA (USA). Georgia Cooperative Fish and Wildlife Research Unit. Dec 1989. 36p. Sponsored by U.S. Department of the Interior. (TR-EL–82-4/82(11.118)). Source: OSTI; US Fish and Wildlife Service, NASA-Slidell Computer Complex, 1010 Gause Blvd., Slidell, LA 70458.

This species profile is one of a series on coastal aquatic organisms, principally fish, of sport, commercial, or ecological importance. The profiles are designed to provide coastal managers, engineers, and biologists with a brief comprehensive sketch of the biological characteristics and environmental requirements of the species and to describe how populations of the species may be expected to react to environmental changes caused by coastal development. Each profile has sections on taxonomy, life history, ecological role, environmental requirements, and economic importance, if applicable. Striped bass are native to coastal rivers and nearshore areas. Populations along the South Atlantic coast are primarily riverine. Spawning begins as early as February and peaks at temperatures of 18–21 °C. Spawning usually occurs in downstream portions of river systems having appropriate waterflow, salinity, temperature, and other water quality characteristics. Striped bass populations have declined since the early 1900's, but enough fish have survived or been restored to support commercial fishing in Albemarle Sound and recreational fishing in most major rivers along the South Atlantic coastline. Striped bass are predators and prey on many sympatric invertebrates and fishes. Larval striped bass feed on aquatic invertebrates and switch to feed on small fish as juveniles and adults. 200 refs., 2 figs., 3 tabs.

49589 (CONF-9009164–2) **Oceanic CO_2 uptake and future atmospheric CO_2 concentrations.** Peng, Tsung-Hung. Oak Ridge National Lab., TN (USA). [1990]. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 2. international symposium on gas transfer at water surfaces; Minneapolis, MN (USA); 11-14 Sep 1990. Order Number DE90017762. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Models of the lateral transport of surface water in the Atlantic, Indian, and Pacific oceans are proposed on the basis of the distribution pattern of bomb-produced ^{14}C in the ocean as observed during the Geochemical Ocean Sections Study program. The global pattern of water column inventories of bomb-produced ^{14}C suggests that an upwelling of bomb-^{14}C-free water takes place in the Antarctic, northern Pacific, and equatorial regions, whereas a downwelling of bomb-^{14}C-rich surface waters occurs in the temperate oceans and northern Atlantic. A global model of the closed ocean-atmosphere system is constructed on the basis of these dynamic flows for the purpose of estimating the oceanic uptake of excess CO_2. The model uses four scenarios of future CO_2 emissions from fossil fuel consumption and tropical deforestation to predict atmospheric CO_2 concentrations. Although the resulting patterns of predicted CO_2 levels are similar to those in the report given by Intergovernmental Panel on Climate Change (IPCC), the uptake of CO_2 from fossil fuel in the lateral transport model is more efficient than that in the general box-diffusion models used by IPCC: that is, all predictions from the model are lower than those given by IPCC. 12 refs., 7 figs., 1 tab.

49590 (CRIE-U–89034) **Development of water purification technologies for intensive fish culture. 2.: Factors affecting nitrification in marine biological filter system.** Kikuchi, K.; Saeki, I.; Uemoto, H.; Kiyono, M. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Nov 1989. 23p. (In Japanese). Order Number DE91701400. Source: NTIS (US Sales Only), PC A03/MF A01.

In the fish culture by biological circulating filter system, a large quantity of ammonia is excreted. It is noxious for fishes, and a rapid elimination is required. The effects of environmental factors on the nitrification in the sea water were examined. The nitrification rate was not affected by changes in the water changing rate and the ammonia concentration. The nitrification rate increased linearly with temperature rise at the range of 10 to 30 centigrade. At 40 centigrade, it was lowered. As for the air-lift in filter bed, physical stimulation was an obstructive factor to the nitrification. Since the alkalinity of recirculating sea water decreases linearly with the progress of nitrification, it is required to add alkali such as sodium bicarbonate in the long-term fish culture. In the long-term loading experiments of organic substances or ammonia, the biofilm on the filter media became thicker due to the multiplication of heterotrophy bacteria. 18 refs., 11 figs., 2 tabs.

49591 (CRIE-U–89035) **Development of water purification technologies for intensive fish culture. 3.: Selection of marine denitrifying bacteria by their denitrification pattern.** Watanabe, Y.; Kikuchi, K.; Uemoto, H.; Takeda, S.; Kiyono, M. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Dec 1989. 23p. (In Japanese). Order Number DE91701401. Source: NTIS (US Sales Only), PC A03/MF A01.

Useful strains of marine denitrifying bacteria were selected for the establishment of effective denitrification system to remove nitrate accumulating in the cultural water of seawater-recirculating aquaculture system. Enrichment culture method was adopted for the isolation of denitrifying bacteria, a higher probability in the isolation was shown by the nitrite added culture method than that by the nitrate added one. The denitrification patterns of isolated denitrifying bacteria were discriminated, and the 16 strains which were considered as useful one for the intensive fish culture system were selected. Since these strains produce only gaseous nitrogen without producing toxic nitrite in the process of denitrification, they are very suitable for the system. As for the genus of 16 strains of which their activities are not changed even in continuous culture, nine strains were genus Pseudomonas and seven strains were genus Alcaligenes. Denitrifying rates of 16 strains were measured by using the acetylene inhibition technique under anaerobic condition. Denitrifying activities ranged from 131 to 4330 n mol-N_2 O/h/mg protein for the strains, the activities depended on the strains. 20 refs., 40 figs., 9 tab.

49592 (DOE/NV/10384–25) **Red Canyon wash infiltration studies.** Hurst, T.L.; Tyler, S.W.; Hess, J.W. Nevada Univ., Reno, NV (USA). Water Resources Center. Sep 1990. 34p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC08-85NV10384. Order Number DE90017652. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The soil-water-climate-vegetation interactions in the substrate of an arid zone, ephemeral wash channel were studied to determine the character, direction, and magnitude of soil-water flux. Thermocouple psychrometers and neutron moisture probe access tubes were placed in 9-m-deep holes drilled in an ephemeral channel and an adjacent interchannel area. Nearly two years of precipitation, runoff, and soil-water data indicated that the combination of periodic flooding and coarse alluvial sediments in the wash channel allowed water to infiltrate below the zone of active evapotranspiration and eventually recharge the regional ground-water system. Conversely, most, if not all, of precipitation falling on the interchannel area was held in the upper 1 to 2 m of soil and there transpired or evaporated. 28 refs., 11 figs., 4 tabs.

49593 (FWS/OBS–81/03) **Willapa Bay: A historical perspective and a rationale for research.** Hedgpeth, J.W. (Hedgpeth

(Joel W.), Santa Rosa, CA (USA)); Obrebski, S. Fish and Wildlife Service, Washington, DC (USA); Hedgpeth (Joel W.), Santa Rosa, CA (USA); Connecticut Univ., Storrs, CT (USA). Apr 1981. 61p. Sponsored by U.S. Department of the Interior. Source: OSTI; U.S. Fish and Wildlife Service, NASA-Slidell Computer Complex, 1010 Gause Blvd., Slidell, LA 70458.

This report provides a historical perspective of a Pacific coast estuarine system – Willapa Bay. The intent of the report is to stimulate estuarine research in an area which is relatively undisturbed. Of particular interest is the importance or value of marshes, tideflats, and eelgrass beds to estuarine fisheries and waterfowl. The research findings as determined for Willapa Bay could be applied to other Pacific Northwest estuaries for coastal problems and decisionmaking. 61 refs., 18 figs., 5 tabs.

49594 (GSF-HY–38/88) **Annual report 1988 of the GSF Institute of Hydrology.** Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Hydrologie. Oct 1989. 271p. (In German). Order Number DE90519861. Source: NTIS (US Sales Only), PC A12/MF A01.

The report contains: (1) Investigation on the migration of pollutants and on groundwater contamination, (2) Precipitation and ground water, (3) Isotope geochemistry, (4) Apparatus and methodological developments, (5) Publications, reports, and lectures. Some papers are individually recorded in the data base. (HP).

49595 (GSF-HY–38/88, pp. 2-8) **Investigation in the propagation of mercury in groundwater of quaternary gravels.** Zahn, M.T.; Seiler, K.P. Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Hydrologie. Oct 1989. (In German). In *Annual report 1988 of the GSF Institute of Hydrology.* Order Number DE90519861. Source: NTIS (US Sales Only), PC A12/MF A01.

The retardation and increased dispersivity in specific materials as caused by sorption and desorption processes in flowing groundwater respectively the uranine tracer are the characteristic features of mercury transport. Mobility of mercury generally goes up as chloride concentrations increase. The column tests were carried through at Dornach near Munich. (DG).

49596 (GSF-HY–38/88, pp. 9-15) **Influence of humic acids on the solubility and sorption characteristics of inorganic cations as exemplified by Cs, Sr, Zr and Nb.** Lang, H.; Wolfrum, C. Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Hydrologie. Oct 1989. (In German). In *Annual report 1988 of the GSF Institute of Hydrology.* Order Number DE90519861. Source: NTIS (US Sales Only), PC A12/MF A01.

The experimental studies demonstrate the influence of natural humic acids on the solubility and sorption characteristics of Cs^{+}, Sr^{2+}, Zr^{4+} and Nb^{5+} through formation of stable complexes. For the investigations, natural sediment and groundwater samples from the surroundings of the Gorleben salt dome were used. The added chemical concentrations of the investigated cations are about 10^{-8} mol/l. (DG).

49597 (GSF-HY–38/88, pp. 16-20) **Determination of diffusion coefficients in cohesive and sandy sediment from the area of Gorleben.** Klotz, D. Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Hydrologie. Oct 1989. (In German). In *Annual report 1988 of the GSF Institute of Hydrology.* Order Number DE90519861. Source: NTIS (US Sales Only), PC A12/MF A01.

The cohesive and sandy sediments stem from shaft driving at the Gorleben salt done. For the cohesive materials, HTD was used as a tracer substance, while $I\text{-}131^{-}$ was used for the sandy materials. Diffusion coefficients of HTD in cohesive materials in their natural texture are in the range of $2x10^{-6}$ to $5x10^{-6}$ cm^2/s, those of $I\text{-}131^{-}$ in the investigated uniform fine and middle sands are approximately $3x10^{-6}$ cm^2/s. (DG).

49598 (GSF-HY–38/88, pp. 75-80) **Low-level tritium measurements in groundwater samples from Stripa-Pluton (Sweden).** Wolf, M.; Moser, H.; Fritz, P. Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Hydrologie. Oct 1989. (In German). In *Annual report 1988 of the GSF Institute of Hydrology.* Order Number DE90519861. Source: NTIS (US Sales Only), PC A12/MF A01.

The investigations in principle confirm that recent ground water (age about 35 years) entered borings in Stripa granite up to 1200 metres deep. A contribution is made towards judging the suitability of granite as an underground storage of radioactive waste. Around the depth of 300/360 metres, ground waters are found to be influenced by tritium from bombs. (DG).

49599 (JOY-LT–16) **The optical parametrization of an aerial multispectral camera.** Silvennoinen, R. Joensuu Univ. (Finland). 1989. 139p. Source: Joensuu Univ, Finland.

This work presents a parametric study of an aerial multispectral camera produced with the aid of small cameras. The effects of the filter, spectrum of light, image motion and vibrations to the resolving power, contrast transfer function and resolution of the multispectral camera under examination are presented in this study. The estimated optical parameters of the aerial multispectral camera under examination are compared with the results from test flights and from practical aerial multispectral photography. Finally, some results of the interpreted variables of natural objects derived from the aerial multispectral pictures produced with the aerial multispectral camera under examination are presented also during the course of this work.

49600 (MIC–90-03223/XAB) **Impact of acidification on the economic value of recreational fishing in eastern Canada. Economic and Commercial Analysis Report No. 14.** Quebec Ministere de l'Environnement, Ste-Foy, PQ (Canada). ©1989. 150p. Source: NTIS, PC EE12/MF E01.

Recreational fishing is one of the most popular outdoor activities in Canada, with direct spending by recreational fishermen generating significant economic activity. There is increasing recognition that acidic precipitation impairs the biological productivity of fish habitat, making game fish more scarce. This study follows a similar report conducted in Quebec using the travel cost method and including a biological variable in the econometric model. The model is based on the relationship, determined by biologists, between the acidity of a body of water and its biological production, measured in biomass per unit of fishing effort. The study included all of Eastern Canada (Ontario, Quebec, the Maritimes). The economic loss related to a decline in biological productivity is represented by a reduction in the number of fishing days and a decline in satisfaction of the remaining users. It is expressed in current dollars per year discounted over 50 years at an annual rate of 10%. The discount reference year is 1988. In total, 5 hypothetical scenarios are evaluated.

49601 (MIC–90-03228/XAB) **Monitoring costs and their implications for direct dischargers in the Ontario mineral industry: Group B, industrial minerals sector.** Ontario Ministry of the Environment, Toronto, ON (Canada). Corporate Resources Div. ©1989. 120p. Source: NTIS, PC EE12/MF E01.

The Municipal-Industrial Strategy for Abatement (MISA) is intended to achieve the virtual elimination of toxic contaminants in municipal and industrial discharges into waterways. Economic assessments are a fundamental component of the MISA program by determining the magnitude of the costs and benefits of various regulations and other program elements, their distribution, and by determining the least-cost mechanisms. This report presents estimates of the incremental costs to industrial minerals plants which are direct dischargers subject to the MISA monitoring regulations. A total of 72 firms with 125 Ontario plant locations are affected, covering cement, chemical lime, clay and shale, graphite, gypsum, magnesium, quarries, sand and gravel and talc. Capital and operating and maintenance costs are estimated by firm for each of sampling requirements, flow measurement, routine analyses, characterization analyses, toxicity testing and reporting.

49602 (MIC–90-03579/XAB) **Chemical use and distribution in the Regina aquifer region. Volume I: Executive Summary – Volume II: Report and appendices.** Saskatchewan Air and Land Protection Branch, Regina, SK (Canada). ©1989. 101p. Source: NTIS, PC EE12/MF E01.

Evaluation of the management and distribution of hazardous chemicals in the Regina aquifer region, as part of an ongoing program to develop a protection plan for the Regina aquifer system. The study involved classifying and estimating the total volume of hazardous chemicals in storage and use; estimating the volume of hazardous chemicals being produced as waste from business and industry; and documenting disposal methods. The survey area included the rural municipalities of Lumsden, Edenwold, Pense, Sherwood and the City of Regina. A total of 169 businesses and institutions participated in completing a questionnaire and conducting a tour of the sites. Estimates of volumes of hazardous chemicals used on-site were provided by the owner or operator representative.

49603 (NIRS-RSD–88) **Radioactivity survey data in Japan, part 1: Environmental materials.** National Inst. of Radiological Sciences, Chiba (Japan). Mar 1990. 25p. Order Number DE90520442. Source: NTIS (US Sales Only), PC A03/MF A01.

The publication is aimed at providing radioactivity survey data in environmental and dietery materials in Japan. Part 1 covers environmental materials, consisting of rain and dry fallout, airborne dust, service water, freshwater, soil, sea water, and sea sediments. Samples were collected from 37 sampling locations during the period between July 1988 and July 1989, and were sent to the Japan Chemical Analysis Center for radiochemical analysis. Strontium 90 and cesium 137 in these environmental materials are tabulated. The maximum concentrations of strontium-90 and cesium-137 were as follows: 0.19±0.074 MBq/Km^2 and 0.63±0.041 MBq/Km^2, respectively, for rain and dry fallout (domestic program); 0.23±0.025 MBq/Km^2 and 0.30±0.031 MBq/m^3 for rain and dry fallout (WHO program); 0.002±0.0016 mBq/m^3 and 0.002±0.0007 mBq/m^3 for airborne dust; 5.4±0.27 mBq and 0.5±0.13 mBq for service water; 5.3±0.25 mBq and 0.8±0.14 mBq for freshwater; and 0.6±0.11 Bq/Kg and 3.1±0.21 Bq/Kg for dried soil. Yearly changes in the concentrations of both strontium-90 and cesium-137 from 1985 through 1989 are given in figures. (N.K.).

49604 (OH/RD–89-296-K) **Canada Brick Quarry ash landfill. Groundwater monitoring and control system modifications, 1989.** Cragg, C.B. Ontario Hydro, Toronto, ON (Canada). Research Div. 11 Dec 1989. 13p. (MICROLOG–90-04000). Source: PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

Fly ash from a thermal generating station is disposed of in an abandoned quarry in Ontario. As part of the licensing agreement for the ash landfill at this site, an underdrainage system was required so that leachate from the landfill could be extracted and treated if the need arose. The system includes a main sump and 2 intermediate sumps. Rehabilitation of the main sump for long-term use and backfilling of the intermediate sumps is described. A network of groundwater monitoring wells was also required under the licensing agreement. Four wells located north of the site to provide background data were rendered inoperable because of housing construction. A description is provided of the installation of new sampling wells in the south end of the landfill. 5 figs., 1 tab.

49605 (OH/RD–89-309-K) **Canada Brick Quarry Ground Water Survey 8th annual report, 1988-1989.** Barber, D.H.; Mlynarczyk, A.Z. Ontario Hydro, Toronto, ON (Canada). Research Div. 15 Dec 1989. 189p. (MICROLOG–90-03996). Source: PC Ontario Hydro Research Division, Editorial Section, 800 Kipling Ave., Toronto, Ont., CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

Analytic data on ground water samples collected from boreholes in and around an Ontario site used for disposal of fly ash from a thermal power station are reported. Piezometric head measurements, chemical analyses of ground water, major ion balances and Piper diagrams are included. Most of the report consists of numerical data. During 1989, new monitoring wells were installed to replace up-gradient wells destroyed during land development. New wells were also installed in the ash-filled area to provide samples of ash leachate before mixing with infiltrated ground water. A major change in sump water ionic chemistry was noted between September 1988 and May 1989, in which ionic fractions of Mg and carbonate increased and Na and chloride decreased. It was likely that this was caused by mixing of a larger fraction of near-surface ground water rather than deep shale leachate with the ash leachate in the sump than had previously been the case. The ionic chemistry returned to the previous characteristics in September 1989. No adverse effect on the ground water quality due to ash disposal has been observed. 10 refs., 29 figs., 46 tabs.

49606 (PB–90-234311/XAB) **Best demonstrated and available technology (BDAT) background document for wastes from the production of epichlorohydrin K017. Final report.** Kinch, R.; Eby, E. Versar, Inc., Springfield, VA (USA). May 1990. 51p. Source: NTIS, PC A04/MF A01.

See also Volume 3, PB–90-234303 and Volume 5, PB–90-234329; Also available in set of 19 reports PC E99/MF E99, PB–90-234279.

The background document provides the Agency's rationale and technical support for selecting the constituents for regulation in K017 and for developing treatments standards for these constituents. The document also provides waste characterization data that serve as a basis for determining whether a variance from a treatment standard may be warranted for a particular type of K017 that is more difficult to treat than the wastes that were analyzed in developing the treatment standards for K017.

49607 (PB–90-234519/XAB) **Final response to BDAT related comments document: D001. Volume 1-B.** Rosengrant, L.; Craig, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 200p. (EPA–530/SW-90/061D). Source: NTIS, PC A09/MF A02.

See also Volume 1-A-3, PB–90-234501 and Volume 1-C, PB–90-234527; Also available in set of 19 reports PC E99/MF E99, PB–90-234477.

The contents of this article include the following: treatment issues concerning aqueous wastes in the ignitable liquids subcategory; other issues concerning treatment standards for the ignitable liquids subcategory; treatment standard for ignitable compressed gases; issues concerning deactivation treatment standards; definitions of subcategories; and dilution.

49608 (PB–90-234618/XAB) **Final response to BDAT related comments document. K071 and K106: Mercury cell process wastes K086: Residues from ink production wastes containing cyanide. Volume 1-L.** Rosengrant, L.; Craig, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 251p. (EPA–530/SW-90/061N). Source: NTIS, PC A12/MF A02.

See also Volume 1-K, PB–90-234600 and Volume 1-M, PB–90-234626. Also available in set of 19 reports PC E99/MF E99, PB–90-234477.

The contents of this article include the following: mercury cell process wastes (data submission only, thermal recovery standard-demonstrability, treatment standard for k071 and k106 wastewater, multimedia impacts, stabilization as bdat option, retain existing bdat standard for k071 nonwastewater, reconsideration of retort cutoff level, and indigenous waste); chlorinated hydrocarbon wastes (no comments were received for this waste code); residues from ink production (treatment standards, subcategories, total chromium vs hexavalent chromium, mixture and derived-from rule, and soft hammer); waste leaching solution from acid leaching of emission control dust/sludge from secondary lead smelting (no comments were received for this issue); and wastes containing cyanide (analytical methodology, bdat, treatment standards, and soil/debri).

49609 (PB–90-234709/XAB) **Background document for Third Third wastes to support 40 CFR part 268 land-disposal restrictions. Final rule. Third Third waste volumes, characteristics, and required and available treatment capacity. Volume 3. Chapter 4. Appendix A-Appendix I.** Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1990. 262p. (EPA–530/SW-90/062C). Source: NTIS, PC A12/MF A02.

See also Volume 2, PB–90-234691 and Volume 4, PB–90-234717. Also available in set of 4 reports PC E99/MF E99, PB–90-234675.

The section of the background document presents a detailed discussion of the methodology (approach) and rationale for the capacity analyses supporting the final rule.

49610 (PB–90-240912/XAB) **US Mussel Watch Program: Transuranic element data from Woods Hole Oceanographic Institution 1976-1983. Technical report.** Palmieri, J.; Livingston, H.; Farrington, J.W. Woods Hole Oceanographic Institution, MA (USA). Coastal Research Center. May 1984. 82p. Contract EPA-68-03-3193. (WHOI–84-28). Source: NTIS, PC A05/MF A01.

Bivalves (Mytilus edulis, Mytilus californianus, Crassostrea virginica and Ostrea equestris) were collected once per year during 1976, 1977, and 1978 along the United States coast and analyzed for (239,240)Pu, (241)Am and (137)Cs as part of the U.S. Mussel Watch program. Monthly samples were collected during 1976-1980 from Narragansett Bay, Rhode Island and Bodega Head, California and analyzed for (239,240)Pu, (241)Am, and (137)Cs. There is no evidence in the data for systematic regional or local elevated concentrations of radionuclides as a result of releases from the nuclear fuel cycle. Monthly fluctuations in radionuclide concentrations in the Narragansett Bay mussels appear to be primarily influenced by spawning.

49611 (PB–90-247164/XAB) **Health assessment for Landfill and Development Company, Mount Holly, New Jersey, Region 2. CERCLIS No. NJD048044325. Final report.** New Jersey Dept. of Environmental Protection, Trenton, NJ (USA). Div. of Science and Research. 20 Jun 1990. 13p. Source: NTIS, PC A03/MF A01.

Landfill and Development Company (L & D) is currently on the National Priorities List (NPL). The L & D is located within Mt. Holly, Eastampton, and Lumberton Townships, in Burlington County, New Jersey. L & D has a history of poor landfill operation and odor complaints (NJDEP, Interim Background Investigation Report). NJDEP has been involved with the permitting, inspection, and regulation of L & D since 1970. On the basis of the information reviewed, the Landfill and Development Site is a potential public health concern because humans may be exposed to hazardous substances at concentrations that may result in adverse health effects. As noted in the Human Exposure Pathways section, human exposure to metals may occur (and may have occurred in the past) via dermal contact, surface waters, and groundwater. The groundwater and surface water sediment at the L & D site have been contaminated with VOCs and metals. The groundwater contamination may potentially extend off-site to nearby potable wells, although neither private nor municipal well sampling performed recently revealed site-related contaminants in any water supplies.

49612 (PB–90-249616/XAB) **Discharge of waste water from CERCLA sites into POTWS. Directive (Final).** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 15 Apr 1986. 8p. (EPA–9330.2-04). Source: NTIS, PC A02/MF A01.

The directive addresses the concerns and issues unique to publicly owned treatment works (POTWs) that must be evaluated before the discharge of CERCLA wastewater to a POTW.

49613 (PB–90-250176/XAB) **Waste-minimization opportunity assessment, Fort Riley, Kansas. Summary report, April 1989-December 1989.** Drabkin, M.; Bridges, J.S. Versar, Inc., Springfield, VA (USA). Jul 1990. 133p. Contract EPA-68-C8-0061. Source: NTIS, PC A07/MF A01.

Under the Waste Reduction Evaluations at Federal Sites (WREAFS) Program, a waste minimization opportunity assessment was conducted at a maintenance operation carried out at one of the U.S. Army Forces Command (FORSCOM) Fort Riley, Kansas facilities. These facilities generate waste battery acid and metals-contaminated alkaline wastewaters. The waste minimization assessment developed two recycling options for these RCRA wastes: (1) Filtration, restrengthening and recycling of waste battery acid as a replacement for virgin battery acid and, (2) purification and reuse of alkaline detergent solution for automotive parts cleaning. The payback periods for these two waste reduction options are very short and create the potential for application of similar waste minimization options in at least ten other U.S. Army FORSCOM installations.

49614 (PB–90-250382/XAB) **Health assessment for Elizabethtown Landfill, Elizabethtown, Lancaster County, Pennsylvania, Region 3. CERCLIS No. PAD980539712. Final report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 11 Dec 1989. 15p. Source: NTIS, PC A03/MF A01.

The Elizabethtown Landfill is a National Priorities List Update 7 site located approximately 1 mile southeast of Elizabethtown in Lancaster County, Pennsylvania. The landfill is currently closed but was operated between 1958 and 1973 for the disposal of industrial and municipal wastes. The current owner and occupant of the site is Waste Management, Inc. (WMI). Remedial activities at the site have included the installation of a leachate collection system, the construction of a sedimentation pond, the installation of a soil gas collection system and flare, and the regrading and capping of the site. Low concentrations of several volatile organic compounds (VOC's) were detected in groundwater samples that were recently collected (1988) from on-site and off-site wells. Private wells with known contamination are not currently being used for drinking water. However, the use of VOC-contaminated water for nonpotable indoor use may lead to VOC inhalation exposures. Workers at the WMI buildings may also be exposed to other landfill gases that escape into the building from the underlying landfill. Potential health risks resulting from exposures to ambient air and the consumption of off-site plants and animals cannot be assessed because of the absence of supporting analytical data.

49615 (PB–90-250424/XAB) **Health assessment for Fletcher's Paint Works and Storage Facility Hazardous Waste Material, Milford, Hillsborough County, New Hampshire, Region 1. CERCLIS No. NHD981067614. Preliminary report.** New Hampshire Dept. of Health and Human Services, Concord, NH (USA). Environmental Health Risk Assessment Unit. 11 Jun 1990. 14p. Source: NTIS, PC A03/MF A01.

Fletcher's Paint Works and Storage Facility Hazardous Waste Site (Fletcher's Paint Site) in Milford, New Hampshire, consists of three distinct entities: Fletcher's Paint Works at 21 Elm Street, Fletcher's Paint Storage Facility on Mill Street, and a drainage ditch leading from the storage facility property to Hampshire Paper Company property. The aggregation of these three properties was based on the similar nature of operations and wastes, the close proximity of the areas, the same target population, and the same underlying aquifer at risk of contamination. The aggregated site has contributed to the contamination of soil, groundwater, surface water, sediment, and air with various volatile organic chemicals (VOCs), semivolatile organic chemicals (SVOCs), heavy metals, and polychlorinated biphenyls (PCBs). Environmental monitoring related to the Fletcher's Paint Site has consisted of sampling of the Keyes Well by the NH WSPCC, and sampling at the paint works, storage facility and drainage ditch by NUS Corporation and EPA's Environmental Services Division (ESD). Contaminant levels at each location is discussed individually. Based upon the available information, the Fletcher's Paint NPL Site is considered to be of potential public health concern because of the risk to public health caused by potential exposure to hazardous substances, such as VOCs, PCBs, PAHs, and heavy metals, at concentrations that may result in adverse health effects. Exposure to contaminated soil and surface water, and potentially contaminated fish may be occurring. The site is located in a densely populated part of town, while the storage facility is readily accessible to children walking to and from school.

49616 (PB–90-250432/XAB) **Health assessment for South Municipal Water Supply Well, Hillsborough County, Peterborough, Cheshire County, New Hampshire, Region 1. CERCLIS No. NHD980671069. Final report.** New Hampshire Dept. of Health and Human Services, Concord, NH (USA). Environmental Health Risk Assessment Unit. 16 May 1990. 30p. Source: NTIS, PC A03/MF A01.

See also PB–90-137837.

The South Municipal Water Supply Well Site is on the U.S. Environmental Protection Agency's (EPA) National Priorities List (NPL). The site area is in a rural portion of the Contoocook River Valley approximately two miles south of downtown Peterborough, New Hampshire. The site consists of two areas: the South Well, located approximately 350 feet east of the Contoocook River, and the New

Hampshire Ball Bearing Inc. (NHBB) manufacturing facility and associated property. Improper disposal practices at NHBB led to contamination of on-site soil, groundwater, and surface water from volatile organic compounds (VOCs), and contamination of sediment from VOCs, metals, polychlorinated biphenyls (PCBs) and polynuclear aromatic hydrocarbons (PAHs). It is not presently clear whether soil contaminants are volatilizing into the ambient air. Off-site contamination includes low levels of VOCs in surface water, PCBs and PAHs in sediments, and VOCs in groundwater. Based on the information reviewed, the authors have concluded that the South Municipal Water Supply Site is of potential public health concern under current conditions because of the potential risk to human health resulting from possible exposure to hazardous substances at concentrations that may result in adverse health effects.

49617 (PB–90-250440/XAB) **Health assessment for Tex Tin Corporation, National Priorities List Site, Texas City, Texas, Region 6. CERCLIS No. TXD062113329. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 16 May 1990. 20p. Source: NTIS, PC A03/MF A01.

The Tex Tin Corporation facility, formerly Gulf Chemical and Metallurgical Corporation, is a proposed National Priorities List site located in Texas City, Galveston County, Texas. Tex Tin previously operated as a primary tin smelter, but currently operates as a copper smelter. Significant concentrations of metals (antimony, arsenic, barium, cadmium, chromium, copper, lead, manganese, mercury, nickel, silver, tin, and zinc) have been detected on-site in surface water, groundwater, and soil. Significant concentrations of metals (arsenic, cadmium, chromium, lead, nickel, and tin) have also been detected in ambient air samples collected off-site. Some remediation activities have occurred on-site including the closure of a 19-million-gallon ferric chloride pond and the removal of approximately 4,000 drums containing radioactive material. The Tex Tin site poses a potential public health concern for on-site workers, residents living in nearby neighborhoods, and possibly for a limited number of residents on private wells located within approximately one mile of the site.

49618 (PB–90-252396/XAB) **Illinois water-quality report, 1988-1989. Final report.** Illinois Environmental Protection Agency, Springfield, IL (USA). Div. of Water Pollution Control. Apr 1990. 372p. (IEPA/WPC–90-160). Source: NTIS, PC A16/MF A02.

See also PB–88-223342. Color illustrations reproduced in black and white.

The State of Illinois report, prepared by the Illinois Environmental Protection Agency, addresses the water quality assessment efforts for 1988 and 1989 (the seventh in a series of biennial reports). The report follows USEPA guidance for reporting water quality conditions in terms of degree of use support or attainment. In addition to stream and lake water quality conditions, discussions of the State's wetland resources and groundwater protection programs are provided. Also included are the lake classification and lake information required by Section 314 and nonpoint source assessments required by Section 319.

49619 (PB–90-253659/XAB) **Health assessment for Tri-City Industrial Disposal Site, Brooks, Kentucky, Region 4. CERCLIS No. KYD981028350. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 18 Jul 1990. 19p. Source: NTIS, PC A03/MF A01.

The Tri-City Industrial Disposal site, located in Bullitt County near Brooks, Kentucky, has been added to the National Priorities List (NPL) by the U.S. Environmental Protection Agency. The site, a landfill, occupies 12 acres and includes one, and possibly two, residences constructed on the filled area. For purposes of the Preliminary Health Assessment, the on-site area is considered to include two residences. Results of a Site Investigation, conducted in 1986 as part of the NPL site nomination protocol, and two follow-up studies have identified heavy metals and volatile and semivolatile organic compounds in the wastes, soils (surface and subsurface), sediment, and groundwater. Additional information is needed to evaluate more fully releases, migration, contaminant levels at points of potential human exposure.

49620 (PB–90-253667/XAB) **Health assessment for GBF, Inc., Dump, Antioch, Contra Costa County, California, Region 9. CERCLIS No. CAD980498562. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 18 Jul 1990. 13p. Source: NTIS, PC A03/MF A01.

The GBF, Inc., Dump site was proposed for the National Priorities List by Update 7. The site is located in Antioch, Contra Costa County, California. The site is currently being operated as a sanitary landfill, but it was used previously for the disposal of chemical wastes. On-site groundwater is contaminated with high concentrations of volatile organic compounds. The extent of off-site groundwater contamination has not been determined. Although the area surrounding the site is serviced by a public water system, several private wells located downgradient of the landfill are used for potable and nonpotable purposes. No contamination of private wells has been reported. Ambient air monitoring at the site has not detected concentrations of air contaminants that pose significant health concerns.

49621 (PB–90-253675/XAB) **Health assessment for Cinnaminson Township (Block 702) Ground-Water Contamination, Cinnaminson, Burlington County, New Jersey, Region 2. CERCLIS No. NJD980785638. Final report.** New Jersey State Dept. of Health, Trenton, NJ (USA). 30 Jul 1990. 12p. Source: NTIS, PC A03/MF A01.

The Phase I Remedial Investigation of the Cinnaminson Groundwater Contamination Study Area was completed in August 1989. The objectives of the Health Assessment, based on the stage of the remediation of the site, are to: assess potential current and past health effects that may be associated with the site; identify, if necessary, additional exposure and sampling locations; identify, if necessary, any actions that could be taken to prevent or minimize exposure to contamination associated with the site; document the concerns of the community with respect to the public health implications of the site; identify information or data gaps relating to the site; and assess whether further health study or evaluation of the site is warranted.

49622 (PB–90-253683/XAB) **Health assessment for Rose Hill Regional Landfill, South Kingstown, Rhode Island, Region 1. CERCLIS No. RID980521025. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 18 Jul 1990. 12p. Source: NTIS, PC A03/MF A01.

The Rose Hill Regional Landfill site, South Kingstown, Rhode Island, was placed on the National Priorities List (NPL) by the U.S. Environmental Protection Agency (EPA). Part of this approximately 70-acre site is owned by the town of South Kingstown and part is owned by a private citizen. The site consists of three separate, inactive disposal areas–a solid waste landfill, a bulky waste disposal area, and a sewage sludge landfill. Disposal operations began in 1967 and ceased in 1983. Ground water has been affected; and municipal water has been extended to most residents in the vicinity of the site. As noted in the Human Exposure Pathways Section, human exposure to heavy metals and VOCs may occur and may have occurred in the past via ingestion of contaminated ground water.

49623 (PB–90-253709/XAB) **Health assessment for Occidental Chemical Corporation Site, Lower Pottsgrove Township, Montgomery County, Pennsylvania, Region 3. CERCLIS No. PAD980229298. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 24 Jul 1990. 15p. Source: NTIS, PC A03/MF A01.

The Occidental Chemical Corporation Site, located in Lower Pottsgrove Township, Montgomery County, Pennsylvania, has been included on the U.S. Environmental Protection Agency's National Priorities List. Several organic compounds and heavy metals, including vinyl chloride, trichloroethene (TCE), arsenic, and chromium, have been detected in on-site monitoring wells and sediment. On-site process wells have also been contaminated with vinyl chloride, trans-1,2-dichloroethene, and TCE. The contamination is apparently emanating from the landfills and lagoons. The site is considered to be of potential public health concern because humans may be exposed to hazardous substances at concentrations that may result in adverse health effects over time; however, no indication presently exists that exposure to contaminants found at the site is occurring.

49624 (PB–90-253717/XAB) **Health assessment for Imperial Oil Co., Inc./Champion Chemicals, Marlboro Township, Monmouth County, New Jersey, Region 2. CERCLIS No. NJD980654099. Final report.** New Jersey State Dept. of Health, Trenton, NJ (USA). 30 Jun 1990. 15p. Source: NTIS, PC A03/MF A01.

The Imperial Oil Company/Champion Chemical (IOC) is an oil blending and recovery facility. Imperial Oil was engaged in the custom blending of lubricants, primarily for the military. The IOC site and its immediate surroundings have demonstrable contamination of soils, surface water, sediments, and groundwater. Among the contaminants are PCBs, arsenic, lead, trichloroethylene, phthalates, and total petroleum hydrocarbons. Public health concerns center around the impact of contamination on area water supply, surface water discharge into recreational areas, and exposure of local residents and workers to contaminated soils.

49625 (PB–90-253725/XAB) **Health assessment for Radiation Technology, Inc., Rockaway, Morris County, New Jersey, Region 2. CERCLIS No. NJD047684451. Final report.** New Jersey Dept. of Environmental Protection, Trenton, NJ (USA). 30 Jul 1990. 13p. Source: NTIS, PC A03/MF A01.

Radiation Technology, Incorporated (RTI) is currently on the National Priorities List. The RTI property is located at 108 Lake Denmark Road, in Rockaway Township, Morris County, New Jersey. Beginning in 1980, the New Jersey Department of Environmental Protection (NJDEP) and the Rockaway Township Health Department (RTHD) conducted numerous facility and area inspections of the RTI site. NJDEP undertook a Remedial Investigation/ Feasibility Study (RI/FS) in 1986. Groundwater sampling results from Phase I of RI/FS revealed excessive amount of VOCs in the RTI study area. The potential human exposures may include ingestion of the VOCs-contaminated well water, dermal absorption and/ or inhalation from cleaning or showering activities.

49626 (PB–90-253733/XAB) **Health assessment for Ewan Property, Shamong Township, Burlington County, New Jersey, Region 2. CERCLIS No. NJD980761365. Final report.** New Jersey State Dept. of Health, Trenton, NJ (USA). 30 Jul 1990. 13p. Source: NTIS, PC A03/MF A01.

The Remedial Investigation (RI) and the Feasibility Study (FS) of the Ewan Property site have been completed. A Record of Decision (ROD) was signed on September 29, 1988. The alternative that will be used to remediate the site has been discussed with concerned citizens at a public meeting in August 1988. At this stage of the study the objectives of the Health Assessment are to: assess the potential current and past effects of the site on public health, evaluate if the selected remedial alternative adequately addresses public health issues, identify any information or data gaps, evaluate if implementation of the remedial alternative could potentially adversely impact public health, identify and recommend immediate actions that could be taken to reduce the public health impacts of the site and site remediation, and assess whether a health study of the site is indicated.

49627 (PB–90-253741/XAB) **Health assessment for Intersil, Inc./Siemens Components, Cupertino, Santa Clara County, California, Region 9. CERCLIS No. CAD041472341. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 18 Jul 1990. 13p. Source: NTIS, PC A03/MF A01.

The Intersil, Inc./Siemens Components site was proposed for the National Priorities List by the Update 7 list. The site is located in Cupertino, Santa Clara County, California. The site consists of two adjacent facilities that manufactured semiconductors. Waste solvents from the facilities have contaminated on-site soils and the underlying aquifer. High concentrations of several volatile organic compounds (VOCs) were detected in groundwater from on-site monitoring wells. The use of VOC-contaminated water in the home could lead to exposures by ingestion, inhalation, or dermal contact. Low concentrations of VOCs were detected in water from one well used by the Santa Clara municipal water system. However, the concentrations of contaminants in water from this well do not pose a significant health risk. The site is of potential public health concern because of possible human exposure to site-related hazardous substances. However, there are no data to indicate that the public is currently being exposed to site-related contaminants at levels of health concern.

49628 (PB–90-254293/XAB) **Superfund Record of Decision (EPA Region 1): New Bedford, MA. (First remedial action), March 1990.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 6 Apr 1990. 251p. (EPA/ROD/R–01-90/045). Source: NTIS, PC A12/MF A02.

The New Bedford site is a harbor area in the port city of New Bedford, Massachusetts, approximately 55 miles south of Boston. Two electrical capacitor manufacturing facilities, the Aerovox facility and the Cornell-Dubilier Electronics facility, are located along the New Bedford Harbor and, were major PCB users from the 1940s to 1978, when EPA banned the use of PCBs. These manufacturers released PCB-contaminated wastewater onto shoreline mudflats and into the harbor. As a result of the widespread PCB contamination, the State closed three fishing areas in the harbor in 1979, resulting in the loss of approximately 18,000 acres of productive lobstering ground. Between 1982 and 1985, EPA and the Coast Guard posted warnings notifying the public of fishing and swimming restrictions. The site has been divided into three study areas which include the Hot Spot area, the Acushnet River Estuary, and the Lower Harbor and Upper Buzzards Bay. This Record of Decision (ROD), the first of two operable units, is an interim remedy and addresses the 5-acre Hot Spot area, located along the western bank of the Acushnet River Estuary adjacent to the Aerovox facility.

49629 (PB–90-254301/XAB) **Superfund Record of Decision (EPA Region 3): C and R Battery, VA. (First remedial action), March 1990. Final report.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 30 Mar 1990. 65p. (EPA/ROD/R–03-90/085). Source: NTIS, PC A04/MF A01.

The 11-acre C and R Battery site is a former battery-sawing and shredding facility in Chesterfield County, Virginia. Open fields and woods border the site on the north, south, and west, a small fuel oil distributor borders the site on the east, and the James River is approximately 650 feet north of the site. From the early 1970s to 1985 the facility was used to recycle discarded batteries. Site operations included draining battery acids into onsite ponds, recovering and stockpiling lead and lead compounds from the batteries, and shredding and stockpiling battery casings onsite. The State began monitoring the site in the late 1970s and detected elevated lead levels in the soil, surface water, and ground water. The selected remedial action for this site includes the demolition of a concrete pad and dismantlement of a storage shed followed by offsite disposal of the debris, and offsite treatment, if necessary, of surface water from the drainage ditch prior to the excavation of contaminated soil and sediment.

49630 (PB–90-254319/XAB) **Superfund Record of Decision (EPA Region 3): Westline, PA. (First remedial action) (amendment), March 1990.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 30 Mar 1990. 11p. (EPA/ROD/R–03-90/086). Source: NTIS, PC A03/MF A01.

See also PB–87-183786.

The Westline site is a former chemical plant in the rural community of Westline, LaFayette Township, McKean County, Pennsylvania. The Day Chemical Company deposited tar material containing phenolic compounds and PAHs into onsite lagoons and into small canals to allow the tar material to migrate downhill towards the banks of Kinzua Creek. Although a 1986 Record of Decision (ROD) addressed the remediation of an additional 2,340 tons of tar and soil found in an onsite tar pit and in some of the interpersed tar deposits along Kinzua Creek, there was still an estimated 4,000 tons of tar material left at the site in the areas planned for excavation. Most of the remaining tar, however, is three feet below the surface and is not a dermal contact threat. The selected remedial action for the ROD amendment is no further action.

49631 (PB–90-254335/XAB) **Superfund Record of Decision (EPA Region 2): Roebling Steel, NJ. (First remedial action), March 1990.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 29 Mar 1990. 97p. (EPA/ROD/RO–2-90/100). Source: NTIS, PC A05/MF A01.

The 200-acre Roebling Steel site is a former steel wire and cable manufacturing facility in the village of Roebling, Florence Township, Burlington County, New Jersey. From 1906 to 1982, the facility was operated primarily to produce steel products, but in recent years, portions of the site have been used for various other industrial operations that have resulted in the onsite generation, storage, or burial of raw materials and wastes. From 1987 to 1988, EPA performed a second removal action. These areas include the remaining drums and exterior tanks, transformers containing PCB-contaminated oils, a baghouse dust pile, chemical piles, tires, and the soil under the water tower in Roebling Park.

49632 (PB–90-257494/XAB) **Health assessment for Waste Engineering, Inc., Sanitary Landfill, Andover, Minnesota, Region 5. CERCLIS No. NMD9806091192 (amended). Final report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 26 Apr 1988. 12p. Source: NTIS, PC A03/MF A01.

See also PB–90-100306.

Waste Disposal Engineering Inc. Sanitary Landfill (WDE), is an NPL site located 20 miles north of Minneapolis in the City of Andover. The 173-acre site was used to landfill municipal refuse and industrial wastes. Volatile organic compounds and lime sludge are the predominant contaminants present at the landfill. The area immediately around the site is characterized by low density housing, agriculture, and some commercial development. The remedial action proposed in the Record of Decision (ROD) will address Agency for Toxic Substances and Disease Registry (ATSDR's) major health concerns for the site. However, prior to cap completion, there is public health concern regarding inhalation and dermal absorption of lime sludge (particularly to the fugitive dust generated) and vapors, as well as ingestion exposure to the lime sludge.

49633 (PB–90-257809/XAB) **Radon-removal techniques for small community public water supplies.** Kinner, N.E.; Malley, J.P.; Clement, J.A.; Quern, P.A.; Schell, G.S. New Hampshire Univ., Durham, NH (USA). Aug 1990. 270p. Source: NTIS, PC A12/MF A02.

The report presents the results of an evaluation, performed by the University of New Hampshire–Environmental Research Group (ERG), of radon removal in small community water supplies using full-scale granular activated carbon adsorption, diffused bubble aeration and packed tower aeration. Various low technology alternatives, such as loss in a distribution system and addition of coarse bubble aeration to a pilot-scale atmospheric storage tank were also evaluated. The report discusses each of the treatment alternatives with respect to their radon removal efficiency, potential problems (i.e., waste disposal, radiation exposure and intermedia pollution), and economics in small community applications. In addition, several sampling methods, storage times, scintillation cocktails and extraction procedures currently used in the liquid scintillation technique for analysis of radon in water were compared.

49634 (QMLCP/SAEF–90-01788) **Determination of the acid level of weakly mineralized waters.** St-Pierre, M. Quebec Ministere du Loisir, de la Chasse et de le Peche, PQ (Canada). Service de l'Amenagement et de l'Exploitation de la Faune. Sep 1988. 20p. (MICROLOG–90-01788). Source: PC Ministere du loisir, de la chasse et de la peche du Quebec, Direction des communications, 150, St-Cyrille Blvd. E., Quebec, PQ, CAN G1R 4Y1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This report is a manual on how to measure the pH of weakly mineralized waters. It is more practical than theoretical. The aspects covered are: definition of the pH value, measuring methods, Nernst equation, and types of electrodes; problems specific of the measurement of the pH in weakly mineralized solutions; manufacturing of buffer solutions; treatment and transportation of samples; how to deal with the electrodes; and the calibration and use of the pH-meter. In conclusion, though pH measurement is not a complex operation, the procedural rules are to be followed rigorously; it is then possible to reach a measurement uncertainty of ± 0.1 to 0.2 pH units. A list of pH-meter manufacturers and retailers is appended to the report. 6 refs.

49635 (RRTAC–89-2-Vol.1, pp. 279-287) **Productivity of agronomic and native plants under various fertilizer and seed application rates on a simulated transport corridor, Fort Norman, Northwest Territories.** Evans, K.E. (Nova Corp. of Alberta, Calgary, AB (Canada)); Kershaw, G.P. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-31 Aug 1989; MICROLOG–90-03281). In *Proceedings of the conference Reclamation, a global perspective: Volume 1.* Source: PC Alberta Queen's Printer, Publications Office, 11510 Kingsway Ave, Edmonton, AB, CAN T5G 2Y5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

In spring 1987, a reclamation study was initiated on an east-west oriented right-of-way, cleared in a decadent, subarctic black spruce forest. The objective was to test the short-term effects of various rates of fertilizer and seed application on the productivity of agronomic (commercially-available) and native plants. The 25m-wide right-of-way was disturbed by 1800 passes of an all-terrain-cycle over a 70m length. The site was seeded and fertilized using a seed mix and fertilizer similar to that employed in other northern reclamation projects. Phytomass of native graminoids, native herbaceous and agronomic seed-mix species, increased after the first and second growing seasons. The average increase in native species phytomass from 1987 to 1988 was 573% in unseeded treatments. Within seeded treatments the average increase in native plant production was 346%. The average increase in agronomic seed-mix phytomass was 454% over the two growing seasons of the study, with the highest productivity occurring in those treatments in which 500 and 1000 kg/hectare of fertilizer were applied. 38 refs., 3 figs., 5 tabs.

49636 (VYH-JULK–22) **Pollution load on the gulf of Finland in 1982-1984.** Pitkaenen, H.; Puolanne, J.; Pietarila, M.; Laeaene, A.; Loigu, E.; Kuslap, P.; Raia, T. National Board of Waters and the Environment, Helsinki (Finland). 1988. 29p. Source: National Board of Waters and the Environment, Helsinki, Finland.

A Report of the Finnish-Soviet Working Group on the Protection of the Gulf of Finland.

The report presents estimated figures and discussion on the pollution load discharged into the Gulf of Finland from direct point sources and via rivers and the atmosphere. The work has been compiled as a co-operation of scientists and experts from Finland and the USSR under the Finnish-Soviet Working Group on the Protection of the Gulf of Finland. During 1982-1984 the Gulf of Finland received on an average 6 800 t a^{-1} of phosphorus, 130 000 t a^{-1} of nitrogen and 410 000 t a^{-1} of organic matter as BOD_7. The figures for BOD and phosphorus were 8 and 18% higher than during 1980-1981, respectively. The increase was largely due to increased water flows in the Soviet rivers, especially in the River Neva. Discharges of nitrogen did not increase markedly during the 1980's. The present values probably underestimate the actual nutrient loading, mostly due to methodological difficulties in assessing discharges from Leningrad which evidently is the most significant individual anthropogenic source of loading by the Gulf of Finland. In spite of water protection measures and improved waste water Treatment in both countries, the total load to the Gulf of Finland increased during the period 1975-1984, due to increased water flows of rivers and increased leaching from land. In the future it is important to pay attention to discharges of harmful substances and the role of atmospheric loading, as well as to the origins and behaviour of riverine discharges. Direct loading discharged into the estuaries should be monitored separately from the riverine load whenever this is possible.

49637 Vapor-phase measurements of volatile organochlorides using fiber optics. Langry, K.C. (Lawrence Livermore National Laboratory, CA (USA)); Angel, S.M. pp. 29, Paper ANYL 94 of American Chemical Society, Division of Analytical Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

Recently, a new type of optorde was developed for the purpose of measuring volatile organochlorides in contaminated groundwater. This device shows dramatically improved performance over previously reported fluorescence-based sensors. The new optrode measurement is based on the absorption of light by a colorimetric indicator that is placed in a 20-ul capillary tube at the end of the optical fiber cable. The analyte is measured in the vapor phase as it diffuses across a membrane and reacts with the optrode reagent, producing a highly colored product that absorbs light at 530 nm.

49638 Fiber optic spectrochemical emission sensor: A detector for chlorinated and fluorinated compounds. Olsen, K.B. (Pacific Northwest Laboratory, Richland, WA (USA)); Griffin, J.W.; Matson, B.S.; Kiefer, T.C.; Flynn, C.J. pp. 59, Paper ANYL 195 of American Chemical Society, Division of Analytical Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

A new chlorine- and fluorine-specific, fiber optic spectrochemical emission sensor (FOSES) has been designed and fabricated at the Pacific Northwest Laboratory. The FOSES is currently designed for real-time in-situ detections of chlorinated and fluorinated hydrocarbons in a field environment. The sensor system design incorporates a RF excitation source, a metered sub-atmospheric pressure helium supply, a critical orifice air inlet, a fiber optic umbilical to transmit analyte emissions to a optical detection system, and a central detection/data acquisition system.

49639 Direct determination of nitrification in marine waters by using the short-lived radioisotope of nitrogen, ^{13}N. Capone, D.G. (Center for Environmental and Estuarine Studies, Solomons, MD (USA)); Horrigan, S.G.; Dunham, S.E.; Fowler, J. *Applied and Environmental Microbiology (USA)*, 56(4): 1182-1184 (Apr 1990).

Biological oxidation of radiolabeled $^{13}NH_4^+$ (half-life = 10 min) was observed within minutes in assays of an estuarine ammonium oxidizer and in natural populations of nitrifiers in coastal waters. Our estimates of turnover of the ammonium pool and rates of nitrification based on experiments using ^{13}N are consistent with previous values in the literature based on longer-term ^{15}N tracer experiments or on indirect methods and thus provide corroboration for the estimates by other researchers.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

Refer also to citation(s) 49158

5501 Behavioral Biology

49640 (PNL-SA–17865) **The ecology of elk in an arid environment: An overview of the Hanford elk project.** McCorquodale, S.M (Yakima Indian Nation, Toppenish, WA (USA). Wildlife Resource Management); Eberhardt, L.E. Pacific Northwest Lab., Richland, WA (USA). Aug 1990. 21p. Sponsored by California Fish and Game Department. DOE Contract AC06-76RL01830. (CONF-9005269–1: Western states and provinces workshop, Eruka, CA (USA), 15-17 May 1990). Order Number DE90017646. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We studied elk (Cerves elaphus) in Washington's shrub-steppe region from 1982 to the present. The population originated from a small number of colonizers that took up residence on the Hanford Site in winter 1972–73. Rapid population growth was facilitated by high reproductive and survival rates. Elk showed strong preferences for bedding in sagebrush (Artemisia tridentata) stands, the only vegetative cover available. Foraging elk typically selected previously burned habitats that no longer supported sagebrush. Elk limited their major diurnal activity, favoring dusk-to-dawn foraging with relatively high nocturnal activity levels. Elk diets were dominated by grasses from winter through early summer and by forbs during the summer drought period. High reproductive success and survival and superior antler growth relative to elk occupying more mesic environments suggested that these elk were effectively utilizing the shrub-steppe environment. Mild, short winters in the shrub-steppe were hypothesized to contribute to reduced winter energy deficits common in temperate herbivores, partly facilitating the observed high fitness. We also hypothesize that in the absence of a significant overstory, the proportion of the range of these elk that would be considered foraging habitat exceeded that typical of elk occupying coniferous forests. Thus, the quantity of foraging areas may have compensated for reduced productivity typical of this region. 29 refs., 3 figs., 2 tabs.

5502 Biochemistry

Refer also to citation(s) 48413, 48465, 49025, 49655

49641 (AD-A–222611/6/XAB) **Computer simulation of chemical reactions in synthetic model compounds and genetically engineered active sites. Final report, 1 July 1989-30 June 1990.** Warshel, A. University of Southern California, Los Angeles, CA (USA). Dept. of Chemistry. 23 May 1990. 6p. Contract N00014-87-K-0507. Source: NTIS, PC A02/MF A01.

The main objective of this project is to advance our understanding of the principles of biological recognition and specificity by using computer simulation approaches. Such approaches are expected to be essential for detailed elucidation of the origin of the enormous power of biological catalysts and to help in exploiting the resulting insight in designing a new generation of highly specific molecular systems. Our computer simulation models have progressed to the level where we can reproduce the effect of genetic modifications of enzymes on its catalytic power in a semiquantitative way. We are also able to estimate in a reasonable way the overall catalytic effect of some enzymes. In three years of this contract we have tried to exploit the fast accumulation of experimental information about genetically modified enzymes in developing clearer design principles. We have progressed in several directions toward this aim: we explored a significant number of genetically modified enzymes (trypsin, subtilisin Aspartateiminotransferase and staphloccocal nucleases) and obtained more confidence in our predictive power.

49642 (CONF-9009243–1) **The effect of denaturation and reduction on cellobiohydrolase 1 from Trichoderma reesei.** Woodward, J. (Oak Ridge National Lab., TN (USA)); Herrmann, P.C. Oak Ridge National Lab., TN (USA). [1990]. 11p. Sponsored by U.S. DOE Energy Research; Solar Energy Research Institute. DOE Contract AC05-84OR21400. From Ethanol from biomass annual meeting; Lincoln, NE (USA); 12-13 Sep 1990. Order Number DE90017324. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The origin of these studies from our interest in the use of protein denaturants to elute cellulase enzyme components from residual cellulosic substrates. A high concentration of the denaturant guanidine hydrochloride, required for elution, was found to only partially unfold the major component of T. reesei cellulase, cellobiohydrolase I(CBH I), and that the reason for the loss in catalytic activity was due to the competitive inhibition of this enzyme and not, as expected, due to its unfolding or denaturation. Papain digestion of CBH I generated "core" enzyme which, apparently, completely broke up upon reduction. These data are discussed in relation to structure/function relationships of this key cellulase enzyme component. In this paper studies on the effect of denaturation and reduction of CBH I are described. The rationale for these studies is to further our understanding of the structure and function relationships of this key cellulase enzyme and to determine the methodology for its successful unfolding and refolding that may be necessary for its recovery. 18 refs., 5 figs.

49643 (DOE/ER/13968–T2) **Mechanism for the selective conjugation of ubiquitin to phytochrome: Progress report for 1989.** Vierstra, R.D. Wisconsin Univ., Madison, WI (USA). Dept. of Horticulture. [1989]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER13968. Order Number DE90017561. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The long term goal of this project is to understand at the molecular level how intracellular proteins are degraded. The purpose of this research is to characterize the form-dependent degradation of phytochrome as a model system for the study of selective protein breakdown. Phytochrome exists in two photo-interconveretible forms, a red-absorbing Pr form and a far-red absorbing Pfr form. Recent evidence indicates that selective breakdown of

phytochrome in etiolated oat seedlings occurs by a ubiquitin-dependent proteolytic pathway. Ubiquitin is a 76 amino acid eukaryotic protein that is covalently ligated to proteins destined for catabolism and serves as recognition signal for proteases specific for ubiquitin-protein conjugates. In an attempt to understand why Pfr and not Pr is recognized by the ubiquitin pathway, we have characterized ubiquitin-phytochrome conjugates (Ub-P) with respect to their kinetics of accumulation, localization within the cell, and sites of ubiquitin attachment. We also examined Pfr degradation in etiolated seedlings from a variety of other plant species (corn, rye, pea and zucchini squash) for their ability to form Ub-P during Pfr degradation. 4 refs.

49644 (LA-UR-90-2856) **Development of a small gantry robotic workcell for deoxyribonucleic acid (DNA) filter array construction.** Beugelsdijk, T.J.; Hollen, R.M.; Snider, K.T. Los Alamos National Lab., NM (USA). [1990]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-9009234–1: Symposium on laboratory robotics, Boston, MA (USA), 16-19 Sep 1990). Order Number DE90016446. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

At Los Alamos National Laboratory, we have constructed a primary cosmid library of human chromosome 16. This library consists of an 11-fold representation of the chromosome and is arrayed in microtiter plate format. A need has arisen in the large scale physical mapping of this chromosome, to array spots of DNA from each of these colonies onto filter media for hybridization studies. We are currently developing a small gantry robot-based workcell to array small spots of DNA in an interleaved format. This allows for the construction of a high spot density format filter array. This paper will discuss the features incorporated into this workcell for the handling of thousands of colonies and their automatic tracking and positioning onto the filter. 7 refs., 3 figs., 1 tab.

49645 (ORNL/FTR–3729) **[DNA repair and mutagenesis]: Foreign trip report, July 23, 1990–August 25, 1990.** Mitra, S. Oak Ridge National Lab., TN (USA). 6 Sep 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90017558. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler visited several highly reputed laboratories involved in DNA repair and mutagenesis studies during his visit in Europe in connection with attending and participating in the 15th International Cancer Congress in Hamburg, W. Germany (August 19–22, 1990). The quality of research involving molecular biological approaches is uniformly excellent in W. Germany and Switzerland and may be at par with that in the US Collaboration with Dr. B. Kaina at the Institute of Genetics at Karlsruhe Kernforschungszentrum (KFK) had been initiated before the visit and was consolidated with concrete plans during the stay of the traveler. The possibility of collaboration with M. Rajewsky at Essen was explored. Prof. Rajewsky has built up an outstanding facility for immunological approaches for studying DNA repair using a newly built 50,000 square foot laboratory. The traveler was gratified to learn at the Cancer Congress that his competitors (in UK and Japan) have not moved ahead of him in experimental plans and results.

49646 Fluorescence line-narrowing spectral analysis of in vivo human hemoglobin-benzo[a]pyrene adducts: Comparison to synthetic analogues. Jankowiak, R. (Iowa State Univ., Ames (USA)); Lu, P.; Small, G.J.; Day, B.W.; Doxtader, M.M.; Skipper, P.L.; Tannenbaum, S.R. pp. 23, Paper ANYL 74 of American Chemical Society, Division of Analytical Chemistry. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

In order to gain insight as to the structure of the adduct formed in vivo between human hemoglobin and the anti-diol epoxide of benzo[a]pyrene (BaP), a series of model compounds was synthesized to investigate the effect on the fluorescence line-narrowing (FLN) spectra of heteroatom substitution at C-10 in BaP tetrahydrotetrol analogues. Spectra taken at 77K by excitation at 355 nm showed marked differences between BaP tetrols and synthetic sulfur, nitrogen, and oxygen adducts of anti-BaP diol epoxide. Human erythrocytes were adducted with racemic, (+), and (–) BaP diol epoxide and analyzed by FLN spectroscopy in an attempt to determine the stereochemistry of the active metabolite of BaP which alkylates hemoglobin in vivo.

49647 Stable isotope labels for DNA sequencing and mapping. Brown, G.M. (Oak Ridge National Laboratory, TN (USA)); Sachleben, R.A.; Burchett, K.L.; Jacobson, D.A.; Larimer, F.W.; Woychik, R.P.; Foote, R.S.; Sloop, F.V.; Jacobson, D.A.; Arlinghaus, H.F.; Thonnard, N. pp. 31, Paper INOR 102 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). DOE Contract AC05-84OR21400. (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

In response to the human genome initiative, a rapid DNA sequencing procedure is being developed that will use stable isotopes, incorporated in organometallic compounds, to label DNA for analysis by resonance ionization mass spectrometry (RIS). A method of attaching isotopes of iron, as ferrocene carboxylamide, and tin, as triethylstanyl-propanamide, to the 5′-end of DNA oligomers has been developed, and the resulting labeled DNA was carried through the entire DNA sequencing procedure of Sanger.

49648 Long range electron-transfer beyond 20Å across rigid polypeptide bridges. Ogawa, M.Y. (Rutgers Univ., Piscataway, NJ (USA)); Isied, S.S.; Wishart, J.F. pp. 54, Paper INOR 184 of American Chemical Society, Division of Inorganic Chemistry. American Chemical Society, Washington, DC (US) (1990). DOE Contract AC02-76CH00016. (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

The authors have prepared an homologous series of unimolecular electron-transfer (ET) complexes having the form, M_1-$(pro)_n$-M_2, where M_1 is $Ru(bpy)_2$(4-carboxy-4′-methyl-2,2′-bipyridine), M_2 is $Co(NH_3)_5$–, and $(pro)_n$ is an oligo-1-proline polypeptide bridge of variable length (n = 0-5). ^1H and ^{13}C NMR measurements indicate that these oligomers adopt a predominately trans-helical conformation where adjacent proline residues are separated from one another by ca. 3.1 Å within a rigid secondary structure. The rates and temperature dependence of the intramolecular electron-transfer reaction (1) $Ru(L)_2(L^{\cdot-})$-$(pro)_n$-Co(III) —> $Ru(L)_2(L)$-$(pro)_n$-Co(II) 1 have been measured by pulse radiolysis for compounds having metal-to-metal separations greater than 15Å ($n \geq 2$). These results will be discussed in terms of distance dependent activation parameters arising from solvent reorganization.

49649 Synthesis of cell wall xylans and glucans by golgi membranes. Gibeaut, D.M. (Purdue Univ., West Lafayette, IN (USA)); Carpita, N.C. *Plant Physiology, Supplement (USA)*, 89(4): 42 (Apr 1989).

We investigated the biosynthesis of mixed-linkage β-D-glucan and glucuronoarabinoxylans which make up the hemicellulosic matrix of the primary cell walls of maize and other cereal grasses. The Golgi apparatus was enriched from plasma membrane and other organelles by flotation density gradient centrifugation. Glucan synthase I and II, which are established markers for Golgi and plasma membrane, respectively, displayed considerable overlap in conventional separations with sucrose density gradients. Flotation gradients improved separation of the membranes substantially, but the different synthases themselves also incorporated radioactivity from either 10 μM or 1 mM UDP-[^{14}C]-glucose into polymer. Relative incorporation of radioactivity into polymers from UDP-[^{14}C]-xylose by the various membrane fractions was nearly identical to relative IDPase activities, indicating that combined xylosyl transferase-xylan synthase represents a new, unequivocal marker for the Golgi apparatus. We also have developed techniques of gas-liquid chromatography and radiogas proportional counting to achieve capillary quality separation of partially methylated alditol acetates with simultaneous determination of radioactivity in the derivatives. Digestion of polymeric products by specific endo-glycanohydrolases to diagnostic oligosaccharides also reveal specific kinds of polysaccharides synthesized by the Golgi membranes. A combination of these techniques provides unequivocal determination of the linkage structure of specific polymers synthesized by the purified Golgi apparatus.

49650 Abscisic acid biosynthesis in isolated embryos of Zea mays L. Gage, D.A. (Michigan State Univ., East Lansing

(USA)); Fong, F.; Zeevaart, J.A.D. *Plant Physiology (USA)*, 89(4): 1039-1041 (Apr 1989). DOE Contract AC02-76ER01338.

Previous labeling experiments with $^{18}O_2$ have supported the hypothesis that stress-induced abscisic acid (ABA) is synthesized through an indirect pathway involving an oxygenated carotenoid (xanthophyll) as a precursor. To investigate ABA formation under nonstress conditions, an $^{18}O_2$ labeling experiment was conducted with isolated embryos from in vitro grown maize (Zea mays L.) kernels. Of the ABA produced during the incubation in $^{18}O_2$, three-fourths contained a single ^{18}O atom located in the carboxyl group. Approximately one-fourth of the ABA synthesized during the experiment contained two ^{18}O atoms. These results suggest that ABA synthesized in maize embryos under nonstress conditions also proceeds via the indirect pathway, requiring a xanthophyll precursor. It was also found that the newly synthesized ABA was preferentially released into the surrounding medium.

5503 Cytology

49651 (LA-UR-90-1548) **A clinical flow cytometry data analysis assistant.** Salzman, G.C. (Los Alamos National Lab., NM (USA)); Stewart, C.C.; Duque, R.E.; Braylan, R.C. Los Alamos National Lab., NM (USA). [1990]. 2p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-901130--1: 12. annual international conference of the IEEE Engineering in Medicine and Biology Society, Philadelphia, PA (USA), 1-4 Nov 1990). Order Number DE90012097. Source: NTIS, PC A02/MF A01 - OSTI.

A rule-based expert system is being developed to assist clinicians in the analysis of multivariate flow cytometry data for patients with leukemias or lymphomas. The cells are stained with fluorescently labeled monoclonal antibodies and the cell fluorescence is measured with a flow cytometer. Cluster analysis is used to isolate subpopulations in the data on which the clinical decisions are made. Symbolic facts for the expert system are instantiated using these numerical data and the knowledge of the clinicians and experts in flow cytometry. The first prototype used a decision tree and rigid rules. Is successfully classified only nine of eleven leukemia cases. A second prototype incorporating certainty factors into the rules is now being developed that should remove the need for a rigid decision tree. 9 refs.

49652 (UCRL-102523-Rev.1) **X-ray holography for sequencing DNA.** Yorkey, T.; Brase, J.; Trebes, J.; Lane, S.; Gray, J. Lawrence Livermore National Lab., CA (USA). [1990]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-900756-16-Rev.1: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90016480. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In this paper we discuss the potential for application of x-ray holographic imaging techniques to the sequencing of DNA. We formulate an approximate model for the scattering of partially coherent x-rays from an oriented DNA fiber and show the feasibility of reconstruction of heavy atom label positions from the x-ray scattering data. A series of simulations has been done to demonstrate the required reconstruction algorithms. An x-ray experiment is currently in progress to demonstrate the real feasibility of the technique. 4 refs., 4 figs.

5504 Genetics

Refer also to citation(s) 49644, 49645

49653 (CONF-8808142--Pt.1) **Genetics and the unity of biology: Proceedings: Part 1 of 2.** Moens, P.B. (ed.). National Research Council of Canada, Ottawa, ON (Canada). ©[1988]. 490p. Sponsored by U.S. DOE Energy Research; National Research Council of Canada. DOE Contract FG02-88ER60682. From 16. international congress of genetics; Toronto (Canada); 20-27 Aug 1988. Source: National Research Council of Canada, Ottawa, Canada K1A 0R6.

Published in Genome; 31: No. 1, 1-490 (1989).

Included in this volume are 87 documents on genetics and molecular biology. Individual documents are indexed separately on the energy database. (KJD)

49654 (CONF-8808142--Pt.2) **Genetics and the unity of biology: Proceedings: Part 2 of 2.** Moens, P.B. (ed.). National Research Council of Canada, Ottawa, ON (Canada). ©[1988]. 668p. Sponsored by U.S. DOE Energy Research; National Research Council of Canada. DOE Contract FG02-88ER60682. From 16. international congress of genetics; Toronto (Canada); 20-27 Aug 1988. Source: National Research Council of Canada, Ottawa, Canada K1A 0R6.

Published in Genome; 31: No. 2, 491-1138 (1989).

This volume contains 106 documents on genetics and molecular biology. Individual documents are indexed separately on the energy database. (KS).

49655 (DOE/ER/60408--2) **Correlation of chromosome patterns in leukemic cells of patients with exposure to chemicals and/or radiation: Progress report, January 1--August 20, 1990.** Rowley, J.D. Chicago Univ., IL (USA). Aug 1990. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER60408. Order Number DE90017603. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Progress made in understanding the molecular genetics of leukemia is described. We have had remarkable success in applying the new techniques of using nonradiolabeled DNA probes to identify chromosome abnormalities more precisely. We have continued to update our series of patients who have treatment related acute myeloid leukemia (AML) and myelodysplasia (MDS). We have identified malignant cells in five adult patients with MDS or AML. Also discussed is mapping DNA probes to chromosome 5.5 refs., 5 figs., 5 tabs.

5505 Metabolism

Refer also to citation(s) 48093, 49720

49656 (AD-A-222838/5/XAB) **Dermal penetration and systemic distribution of ^{14}C-labeled vitamin E human skin grafted athymic nude mice.** Klain, G.J. Letterman Army Inst. of Research, San Francisco, CA (USA). 13 Mar 1989. 7p. Source: NTIS, PC A02/MF A01.

Pub. in International Jnl. for Vitamin and Nitrition Research, Vol. 59, 333-338(13 Mar 1989).

In vivo percutaneous penetration and tissue distribution of 14C-labeled vitamin E applied to human skin grafted onto athymic nude mice were determined. At 1 hr, mouse skin contained the highest level of radioactivity, followed by the muscle, blood, liver, lung, adipose tissue, spleen, kidney, brain, heart, and eyes. A linear increase with time in tissue radioactivity was observed throughout the 24 hr experimental period. At 4 and 24 hrs skin grafts were highly radioactive. At 4 hrs the epidermis and the upper portion of the dermis contained more radioactivity than the remaining portion of the dermis. In contrast, at 24 hrs the highest level of radioactivity was detected in the lower dermis. No radioactivity was detected in expired air while 0.2% of the dose was found in the urine. The data show that vitamin E does penetrate skin and that the dermis acts as a barrier or reservoir for this highly lipophilic compound.

5506 Medicine

Refer also to citation(s) 49346, 49347, 49348, 49349, 49350, 49351, 49353, 49360, 49363, 49709, 50064

49657 (BIR-18, pp. 63-65) **The use of a silicon surface barrier detector for quality assurance in diagnostic radiology.** Pani, R. (Univ. 'La Sapienza', Rome (Italy). Sez. Fisica Medica e Sanitaria); Ballesio, P.L.; Laitano, R.F.; Pellegrini, R.; Soluri, A. British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161--: Workshop on technical and physical parameters for quality

assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

A number of X-ray spectra in the radiodiagnostics energy range have been measured by a Si detector. The results obtained show that this type of detector is sufficiently accurate for X-ray spectrometry in quality-control programmes for radiodiagnosis equipment. In particular, Si detectors for diagnostic X-ray spectrometry are, in comparison with Ge detectors, much less expensive and more practical for use in the usual operational conditions in radiological departments. (author).

49658 (BIR–18, pp. 2-10) **The relationship between medical diagnostic requirements and limiting values of technical and physical parameters for image production.** Stender, H. St. (Pregelweg 5, Isernhagen (Germany, F.R.)); Stieve, F-E. British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The conversion of radiological image into a radiograph is always accompanied by loss of information. The quality of a radiograph can be expressed quantitatively by means of four components: contrast, resolution power, unsharpness and noise. In order to make radiographs comparable, the following requirements should be fulfilled: (a) representation in determined projections (so-called "standard projections"), (b) imaging as "harmonic image" in the whole contrast scale of the parts that are important for the diagnosis of the radiograph (so-called "dominants"), (c) adjustment of the mean optical density to the optimal contrast sensitivity of the eye, (d) extensive elimination of disturbing influences (e.g. motion, scattered radiation, veiling glare), and (e) reduction of the radiation exposure to values at which image details and critical structures are still perceptible. To fulfil these requirements, good radiographic technique and minimum values of the physical image parameters are needed. The influence of these parameters on the quality of the radiograph by changes in the projection, mean optical density, object latitude, contrast of details, exposure time and contrast transfer will show what can be claimed for an "optimal" radiograph and what deviations from the optimal value can be accepted. (Author).

49659 (BIR–18, pp. 10-15) **Physical aspects of establishing tolerances and limiting values in diagnostic radiology.** Moores, B.M. (Christie Hospital and Holt Radium Inst., Manchester (UK)). British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Specification and measurement of performance is the cornerstone of quality control in diagnostic radiology. This paper deals with the background to the measurement process and in particular what is meant by accuracy and precision. The relevance of these two quantities to both the tolerances imposed on the measurement process and the limiting value of the measured quantity is highlighted. The framework for quality control in diagnostic radiology is described together with the need to match the tolerances of the measurement process to the regime employed in tests associated with specifying performance in the factory, in the X-ray department upon installation, or monitoring performance during routine operation. Error analysis is used to determine overall effects on the final outcome of the limiting values associated with individual parameters. The multi-parameter expressions used in this analysis also have an important role to play in optimisation analyses of the radiological process. (Author).

49660 (BIR–18, pp. 16-19) **Organizing quality control programmes.** Hjardemaal, O. (Statens Inst. for Straalehygiejne, Copenhagen (Denmark)). British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

When procuring new equipment, performance and safety should be specified, if possible by reference to international standards. Some of the characteristics of the International Electrotechnical Commission (IEC) standard for X-ray generators, in particular the accuracy of the operating data, are described. The quality control tests to be performed after installation comprise acceptance test, status test and constancy test. The first two involve absolute measurements and will be the responsibility of physicists or engineers. Apparently limiting values stipulated by users are a factor of two lower than the limits of the IEC standard. By means of an example it is shown that modern X-ray generators can meet the lower limits of the users without problems. In order to obtain optimum initial quality when procuring new equipment operating data, limiting values must be specified and must be verified by acceptance testing, etc. However, in many countries physicists and engineers are not available for this job. A relatively uncomplicated test object can be used by radiographers for checks on fluoroscopic systems. The findings from such tests in Denmark are compared with other published findings and good agreement is found. Therefore it is proposed that such uncomplicated tests could form the basis for quality evaluation. (author).

49661 (BIR–18, pp. 20-24) **Procuring, maintaining and using equipment: the key issues in controlling exposure to patients.** Hendra, I.R.F. (Dept. of Health and Social Security, London (UK). NHS Procurement Directorate). British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Radiological equipment is not purpose-built for each individual application. Thus, not only are acceptance criteria directly related to the design of equipment and the quality assurance exercised during its manufacture, but also the performance, safety and reliability of equipment must feature in the requirements for procuring new equipment. In the UK this issue is dealt with under the Department of Health and Social Security Manufacturer Registration Scheme for Medical Equipment in its application to radiological

equipment. Similarly the continuing reliability of equipment in service is directly related to the quality of maintenance services. This is determined largely by the manner in which such services are procured. In the UK this issue has been considered by one of four Working Parties commissioned by the South-East Thames Regional Health Authority who are the "Centre of Responsibility" for diagnostic imaging equipment. The report prepared from the first phase of activity of this working group describes features of a procurement specification for maintenance services and prescribes the complementary duties of contractors and customers. The use in X-ray departments of the kind of manufacturing quality system that is used by most reputable equipment manufacturers has the potential for a dramatic reduction in exposure to patients. (author).

49662 (BIR–18, pp. 25-26) **Proposed limiting values for performance criteria in acceptance testing of diagnostic X-ray equipment in the Federal Republic of Germany.** Baeuml, A. (Inst. fuer Strahlenhygiene des Bundesgesundheitsamtes, Neuherberg (Germany, F.R.)). British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

In the Federal Republic of Germany a new X-ray ordinance came into force in 1988 containing a specific paragraph on quality assurance for all medical X-ray units stipulating acceptance tests, regular checks and supervision by medical bodies and the competent authorities. Acceptance testing is to be performed by engineers from the equipment suppliers or manufacturers in new and also existing installations. It is expected that the service engineers will adjust the equipment in such a way as to obtain optimal performance before measurements are made, the results of which are to be stated in a certificate describing the quality status of the equipment. A working group has developed guidelines for these acceptance tests. The items to be measured are reported and the proposed limiting values and their tolerances are discussed. (author).

49663 (BIR–18, pp. 26-28) **The Northern Regional Programme for the acceptance testing of X-ray equipment.** Faulkner, K. (Newcastle General Hospital (UK)); Harrison, R.M.; Kotre, C.J.; Smith, S.; Davies, M.; Barker, P. British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Since 1984 the Regional Medical Physics Department has participated in a regional acceptance testing programme for all X-ray equipment from mobile units to computed tomography scanners. The organizational and radiation physics aspects of the programme are described. Three levels of tests are performed by physicists: the first on installation, the second after 3 months, and the final visit just prior to the end of the manufacturer's warranty. The second test is only performed if any aspect of performance requires rechecking as a result of the first visit. Acceptance test protocols are based on those published by the Institute of Physical Sciences in Medicine. Details of the limiting values for the acceptance test measurements are given. The results of the programme are discussed. In some instances the testing has resulted in modifications to the design and construction of X-ray equipment. Acceptance testing is important in determining a baseline standard of performance against which routine quality assurance may be assessed. (author).

49664 (BIR–18, pp. 28-31) **Mandatory quality assurance programmes for diagnostic radiology facilities in Ontario, Canada: Minimum requirements and limiting values.** Rainbow, A.J. (McMaster Univ., Hamilton, ON (Canada)). British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Regulations made under the Healing Arts Radiation Protection (HARP) Act, Government of Ontario, Canada, were promulgated in the form of a safety Code in November, 1985. These regulations require a minimum technical quality assurance (QA) programme for all diagnostic radiology facilities in the Province. The mandatory QA programme requires certain tests and procedures to be carried out at specified intervals. The tests include photographic quality control, patient entrance exposure measurement, collimation, half-value layer, phototiming parameters, fluoroscopic parameters including maximum patient entrance exposure rate, resolution, limit timer and automatic brightness control, and tomographic parameters including fulcrum accuracy, thickness of cut and mechanical stability. Records of the results of these tests must be kept for at least 6 years. A set of HARP guidelines published in June 1987 includes a description of appropriate measuring methods for each test together with a set of forms for recording the results of such tests. The regulations specify limiting values for a number of equipment performance parameters, including the maximum allowable patient skin entrance exposure values for common radiographic projections. (author).

49665 (BIR–18, pp. 31-33) **Methods of measurement, accuracy and tolerable deviations.** Kallinger, W. (Krankenhaus der Stadt Wien-Lainz (Austria). Pruefanstalt fuer Radiologie); Freund, R.; Plundrak, P.; Bednar, R.; Schink, O.; Schachner, J.; Kuntner, M. British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The Secretary of Public Health in Austria asked for a statistical investigation of the physical parameters which contribute to image quality in X-ray diagnosis. This survey resulted in the finding that the resolution in X-ray exposures showed a variation between 2.0 and 5.7 1p mm^{-1}. However, most of the institutes visited had results near 5 1p mm^{-1}, and so it seemed worthwhile to investigate those with values below 3 1p mm^{-1}. For X-ray exposures the minimum resolution should be $\geq$3.4 1p mm^{-1} and in fluoroscopy $\geq$0.9 1p mm^{-1}. (author).

49666 (BIR–18, pp. 33-37) **Quality assurance and the World Health Organization initiative of 'Health for All'.** Hanson, G.P. (World Health Organization, Geneva (Switzerland)). British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities,

Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Following a workshop held in Neuherberg, FRG, in 1980 a guide for quality assurance in diagnostic radiology was published by WHO in 1982. Quality assurance programmes were recognized as being necessary for three main objectives: first the improvement of medical diagnostic imaging, secondly cost containment, and thirdly the reduction of radiation exposure. Concurrently, because of the paramount importance for basic diagnostic imaging, WHO prepared Technical Specifications for the X-ray Apparatus to be Used in a Basic Radiological System (BRS), governed by the concepts of "design-out maintenance" and "design-in quality assurance". The outcome of WHO's efforts, in comparison with the recognized quality assurance objectives, indicates that, although it is too early to measure overall improvements in medical diagnostic imaging, the two main aspects, accessibility and image quality, should be improved. Regarding cost containment, elimination of many logistical and support requirements should result in considerable savings. Regarding the reduction of radiation exposure, and using the entrance skin exposure as an indicator, an important finding is that with the WHO-BRS type X-ray equipment, in most cases the patient exposure was less than the average values in the United States. (author).

49667 (BIR–18, pp. 37-40) **An overview of the International Electrotechnical Commission's activities on quality assurance in diagnostic radiology.** Julius, H.W. (Radiological Service TNO, Arnhem (Netherlands)); Ammers, H. van; Henshaw, E.T. British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

In 1981, the International Electrotechnical Commission Subcommittee 62B set up a Working Group (WG 10) to deal with quality assurance in diagnostic X-ray departments and, more specifically, to develop international standards describing procedures to test the constancy of parameters of diagnostic X-ray installations. Since then, the working group has produced a report on General Aspects of Quality Assurance in Diagnostic X-ray Departments and four draft standards on specific topics, while seven more documents are in advanced drafting stage. Several others are presently under consideration. According to the approach adopted by the Working Group, these documents are meant to assist in establishing quality assurance programmes in hospitals and provide guidance on how to perform the tests and interpret their results. This paper reveals the general philosophy behind the activities of the Working Group as well as some details of the standard produced so far, with emphasis on the physical parameters of diagnostic X-ray installations and their proposed criteria for satisfactory performance. (author).

49668 (BIR–18, pp. 40-43) **Practical aspects of uniformity and intercomparison of quality control tests.** Henshaw, E.T. (Radiation Protection Seervice, Liverpool (UK)); Julius, H.W.; Ammers, H. van. British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Quality control programmes, the relevant technical and physical parameters, test methods and tolerances, and the determination of appropriate limiting values are examined in relation to the desirability and practicality of (a) making intercomparisons between test methods and (b) achieving overall uniformity. (author).

49669 (BIR–18, pp. 44-47) **Image field size and beam collimation in fluoroscopic equipment.** Brennan, A.G. (Christie Hospital and Holt Radium Inst., Manchester (UK)); Shaw, A.J.; Jones, A.P. British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Image field size and beam collimation are usually measured at all image size settings on fluoroscopic equipment at acceptance and periodically thereafter. Image field size is normally measured using a rectangular wire grid and beam collimation is generally measured using a fluorescent screen or radiographic cassette. These are then compared with the nominal entrance field size to determine acceptance. There are, however, no internationally established limiting values for image field size and beam collimation in fluoroscopy. In Britain it is accepted that the ratio of the image field size diameter to the nominal field size diameter should have a minimum limiting value of 0.85, and it is proposed that this be adopted. It is also proposed that the beam collimation be compared with the image field size rather than the nominal field size, and that the ratio of the radiation field size diameter to the image field size diameter should have a maximum limiting value of 1.1. The tolerances inherent in both these measurements are discussed. The frequency with which image field size and beam collimation measurements outside these limiting values were identified on a large number of fluoroscopic units is presented. (author).

49670 (BIR–18, pp. 47-51) **Field size and centring for conventional X-ray equipment.** Klimpel, H. (Technischer Ueberwachungs-Verein, Hannover (Germany, F.R.). Hauptabteilung Kerntechnik und Strahlenschutz); Kreienfeld, H.; Overbeck, R. British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Since 1973, all X-ray equipment for medical applications in the Federal Republic of Germany has had to be examined according to the requirements of the German "Rontgenverordnung" before it is used on patients and after each essential modification of design or construction. These examinations are carried out by inspectors appointed by the authorities, e.g. TUV. The field size adjustment

and the centring of the radiation beam in relation to the image reception area is checked, along with other tests. To increase quality assurance in X-ray diagnosis, since the mid-1980s X-ray equipment has also been subject to in-service inspections to an increasing extent. (author).

49671 (BIR–18, pp. 51-54) **Radiological properties of an automatic exposure control system.** Kramer, H.M. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)); Hoeschen, D.; Seguin, H. British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The energy dependence of the response of an ionization chamber used in the chain of the Amplimat/Philips automatic exposure control system was determined with respect to air kerma and with respect to the dose requirement of two different film-screen combinations. The investigations have been divided into those with negligible dose contributions due to scattered radiation and those with well known ratios between direct and scattered radiation. Information on the relative dose contributions of direct and scattered radiation behind a water-equivalent phantom have been obtained by experimental investigations and by Monte Carlo simulations. The agreement between the two methods is within a few per cent. It will be shown that in such fields film-screen combinations and the ionization chamber have significantly different behaviour. This is in line with the experience of radiologists, who (depending on patient thickness and tube voltage) vary the setting of the automatic exposure control system. (author).

49672 (BIR–18, pp. 54-60) **A review of automatic exposure control of conventional and digital systems.** Workman, A. (Leeds General Infirmary (UK)); Cowen, A.R. British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The desirable properties and methods of achieving automatic exposure control in film-screen radiography, fluoroscopy, spot-film fluorography and cinefluorography are discussed. Advantages of certain methods in achieving optimum image quality for minimal patient exposure are considered. In digital subtraction fluorography (DSF) where relatively large exposure levels per image are used, proper set-up of exposure conditions is of particular importance. These systems require a high degree of stability in exposure to maintain a high level of image quality. We have developed test methods for monitoring the set-up and reproducibility of exposure levels in DSF. (author).

49673 (BIR–18, pp. 60-62) **Determination of high voltage: Methods of measurement, practicality, accuracy and regulations concerning tolerances.** Rehm, H-J. (Klinikum Nuernberg (Germany, F.R.). Dept. of Medical Physics); Boehnlein, G.; Schmidt, Th. British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The quality of an X-ray image is influenced by the radiation parameters (kV value, filtration) because of their impact on contrast and contrast resolution. Deviations from the nominal high voltage of an X-ray tube may lead to unnecessary exposure of the patient and complicate the comparability of X-ray images, which is why there is interest in an easy to handle, non-invasive method of determining the high voltage of an X-ray tube. For the purposes of constancy, several non-invasive high-voltage test tools have been developed, some of which work on the principle of modified film cassettes with two different intensifying screens or different optical extenuations, while others use a "two filter method" with photodiodes (electronic kV meters). The accuracy, reproducibility and practicality of two test cassettes and five electronic kV meters have been investigated and their usefulness with respect to national regulations and physicians' demands is discussed. (author).

49674 (BIR–18, pp. 65-67) **Patient equivalent phantoms in chest radiography.** Servomaa, A. (Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland)); Tapiovaara, M. British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The attenuation properties of several phantom materials such as aluminium, copper, acrylic, water and some anatomic phantoms, such as male and female Alderson-Rando phantoms, have been studied. The measurements were made in a narrow-beam geometry with an ionization chamber and with an X-ray spectrometer consisting of a Ge semiconductor detector and multichannel analyser. The results of the spectral measurements show that the spectral equivalence between LucAl and Alderson-Rando phantoms is good. The absorption of low-energy photons in aluminium and copper is much larger than in LucAl. These materials can be used only for a particular set of X-ray system parameters. The best spectrally equivalent material compared with LucAl is water. The attenuation measurements made with an ionization chamber agree with the spectral measurements. The results of the spectral and attenuation measurements are described. (author).

49675 (BIR–18, pp. 68-70) **A protocol for the commissioning and routine testing of mammographic X-ray systems.** Fitzgerald, M. (St. George's Hospital, London (UK). Dept. of Medical Physics and Bioengineering); Dance, D.R.; Fisher, K.; Lawinski, C.; Ramsdale, M.L. British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

A national breast cancer screening programme is being organized in the UK over a 2-year period commencing in 1988. It is

based on the mammographic X-ray examinations of women aged 50-64 at 3-year intervals. This has engendered much interest in physical measurements on mammographic X-ray systems and the Diagnostic Radiology Topic Group of the Institute of Physical Sciences in Medicine has formed a working group to produce a protocol for the commissioning and routine testing of mammographic X-ray systems, to include X-ray sets, screen-film systems and automatic processing units. This paper summarizes the main recommendations of the group regarding the physical measurements thought to be essential to characterize the performance of a new X-ray set, including suggested limiting values and measurements tolerances for some of the quantities. (author).

49676 (BIR–18, pp. 70-72) **Screening with mammography - what quality is required and how is it checked?.** Leitz, W. (National Inst. of Radiation Protection, Stockholm (Sweden)). British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods*. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The medical value of screening for breast cancer with mammography has been proved in Swedish trials, in which a 30% reduction of breast cancer mortality was observed. However, the benefits may easily be lost if the examinations are not performed in accordance with the most stringent requirements. With the prospect of general screening with mammography all over Sweden, the National Health Board and the National Institute of Radiation Protection have issued guidelines on how screening is to be organized. Far-reaching recommendations concerning X-ray equipment, film processing, radiation dose, and image quality are in preparation. The basis of these recommendations, their background and the underlying field experience are the subject of this paper. A mammographic system regarded as the optimum presently achievable serves as a reference. Comparison is made with other systems based on performance measurements of the X-ray equipment (i.e. tube voltage, radiation output, beam quality), a sensitometric evaluation, dose measurements, and image quality measurements including spatial resolution and quantitative assessment of contrast and fraction of scattered radiation. The test methods are described and the criteria for acceptance of a system are discussed. (author).

49677 (BIR–18, pp. 73-76) **A phantom for quality control in mammography.** Gambaccini, M. (Ferrara Univ. (Italy)); Rimondi, O.; Marziani, M.; Toti, A. British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods*. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

A phantom for evaluating image quality in mammography has been designed and will be used in the national programme "Dose and Quality in Mammography". The characteristics of the phantom are (a) about the same X-ray transmission as a 5 cm 50% fat and 50% water breast for energies between 15 and 50 keV and (b) optimum energies for imaging of the test objects (included in the phantom) in very close agreement with the optimum energies for imaging of calcifications and tumours in a 5 cm 50% fat and 50% water breast. An experimental comparison between the prototype and some commercial phantoms was carried out. Measurements are in progress to test the phantom's ability to evaluate the performances of mammographic systems quantitatively. (author).

49678 (BIR–18, pp. 76-79) **An electronic instrument for high-voltage measurements of an X-ray unit for mammography.** Gambaccini, M. (Ferrara Univ. (Italy)); Rimondi, O.; Marziani, M. British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods*. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

An instrument for high-voltage measurements of an X-ray unit for mammography consists of a radiation probe, an acquisition circuit and an analogue/digital converter connected to a personal computer. The probe is composed of two photodiodes, one covered by an Al filter and the other by a Mo filter. The wave-form measurements of a three-phase six-pulse unit (50 Hz power line frequency, 0.1 s exposure time, Mo anode X-ray tube, 0.8 mm Be window and 39 μm Mo filter) performed using the electronic system were compared with those made using a voltage divider and a digital oscilloscope. The measurements were carried out for seven voltage values from 25 to 39 kVp. The differences between the invasive and indirect data were lower than 2% for voltage maxima (kVp) and lower than 5% for minima. The systematic error depending on the total filtration of the X-ray beam was also considered. The instrument will be used in the national programme "Dose and Quality in Mammography". (author).

49679 (BIR–18, pp. 79-81) **Quality control of dental X-ray units.** Havukainen, R. (Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland)). British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods*. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

There are 4000 dental X-ray units in use in Finland. Inspections by the Finnish Centre for Radiation and Nuclear Safety (STUK) have disclosed a great variation in patient dose and many equipment failures. The range of the air kerma value in bite-wing projections at the end of the cone was 0.5-151 mGy and the mean value about 6.2 mGy, and the air kerma was higher than the recommended value of 7 mGy in 30% of units. Failures were found in 20% of units. The high doses usually arose from incorrect film processing and most malfunctions were found in old units. A type-testing method has been developed and the requirements for new dental units have been laid down in a directive issued by STUK in 1987. The units are type-tested and then exempted from on-site inspection. To ensure that the units that are sold are similar to the type-tested one, STUK makes random inspections. A postal control system will be used periodically to detect unusually high doses, and will also be used to follow the collective dose estimates from dental radiography. It is expected that with the new procedure control of dental X-ray equipment, detection of unnecessarily high doses and reduction of the collective dose will be achieved more effectively than before. (author).

49680 (BIR–18, pp. 81-84) **Quality assurance of computed tomography scanner beams in diagnostic radiology.** Lindskoug,

B.A. (Halmstad Regional Hospital (Sweden). Regional Dept. of Radiation and Hospital PHysics). British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The number of computed tomography (CT) scanners in diagnostic radiology is increasing, to the extent that they are now found in relatively small hospitals. These hospitals do not have local physicists available and so methods must be developed to allow quality assurance to be carried out at distant laboratories. Several different types of solid water phantoms are available with various built-in test objects that may supply sufficient information about the many parameters that must be checked. The dose distributions, however, are usually not so well considered, although the connection between image quality and absorbed dose must be known for optimal use of a CT scanner. By introducing thermoluminescent dosemeters (TLDs) into a commercial phantom (RMI), it was possible to measure the absorbed dose profile and the line integral of the absorbed dose across the slit. The computer-guided readout of the TLDs gives the absorbed dose, the average dose and half maximum width, absorbed dose curve, and also the line integral of the peak. The only modification of the phantom was five holes, drilled at strategic positions, that did not influence the built-in test objects. This single measurement provides an appropriate monthly quality assurance check of the CT scanner with little extra effort. (author).

49681 (BIR–18, pp. 84-86) **Quality control in quantitative computed tomography.** Jessen, K.A. (Aarhus Univ. (Denmark). Aarhus Kommunehospital); Joergensen, J. British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Computed tomography (CT) has for several years been an indispensable tool in diagnostic radiology, but it is only recently that extraction of quantitative information from CT images has been of practical clinical value. Only careful control of the scan parameters, and especially the scan geometry, allows useful information to be obtained; and it can be demonstrated by simple phantom measurements how sensitive a CT system can be to variations in size, shape and position of the phantom in the gantry aperture. Significant differences exist between systems that are not manifested in normal control of image quality and general performance tests. Therefore an actual system has to be analysed for its suitability for quantitative use of the images before critical clinical applications are justified. (author).

49682 (BIR–18, pp. 87-90) **Quality control in computed tomography X-ray scanners.** Perry, B.J. (St. George's Hospital, London (UK). Dept of Medical Physics and Bioengineering); Edyvean, S. British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Practical methods of estimating computed tomography X-ray scanner imaging performance treat the scanner as a black box, the measurements usually being non-invasive. The performance of individual components or groups of components within the system is not usually measured. The digital nature of the imaging process allows direct numerical assessment of the actual imaging parameters. This approach is used for type and acceptance testing as well as quality control, the type and acceptance tests providing the baseline for subsequent quality control measurements. The usual X-ray imaging parameters of noise, resolution and dose can all be used for quality control purposes, but the relative emphasis between these parameters will differ when compared with type or acceptance testing. Other simple measurements may be of equal use. All manufacturers suggest quality control protocols of varying complexity using a wide range of phantom designs. Where quality control is undertaken routinely, it is usually the manufacturer's protocols that are followed. It is pertinent to ask whether the quality control measurements currently suggested are necessary and/or sufficient. (author).

49683 (BIR–18, pp. 91-92) **Speed and speed classes of film-screen systems: Determination and practical application.** Borcke, E. (Agfa-Gevaert AG, Muenchen (Germany, F.R.)). British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

In order to carry out the DIN 6868, Part 50(1988) acceptance test within the framework of measures of quality assurance, the dose of the film-screen combination used is needed in the plane of the cassette. Recent methods for determination of sensitivity use the film-screen system instead of artificial light and decisions can be made as to the dose of the cassette plane. In order to characterize the sensitivity, it is proposed to use a given scale of numbers for the sensitivity S in increments of $\Delta \log S = 0.05$ in numerical values. It will also be useful for practical purposes to employ the "sensitivity class" with 2-fold increments in order to bring the planned radiological specifications into agreement with the demands of the user. (author).

49684 (BIR–18, pp. 93-95) **Film-screen characteristics.** Hoeschen, D. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)). British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The measuring methods for the determination of characteristic imaging parameters of screen-film systems, i.e. the characteristic curve, the modulation transfer function and Wiener spectrum, are described. Results, together with measurement uncertainties, are

given and discussed. It is proposed to reduce the measurement uncertainties by standardizing the methods. However, an overall image quality parameter, such as the detective quantum efficiency, is not yet available. (author).

49685 (BIR–18, pp. 95-97) **Reduction of X-ray film processing variations.** Legros, J. (Kodak Pathe, Chalon-sur-Saone (France). Photographic Technology Centre); Bayol, R. British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The reduction of variations in automatic and manual X-ray film processing depends on parameters linked to the processor ("mechanical") and parameters linked to the processing solutions ("analytical"). The most important parameters are reviewed and the monitoring methods are discussed. The advantages of sensitometric tests are shown and the ways of carrying them out are described. It is demonstrated that careful analysis of trends and drifts during sensitometric tests is one of the most efficient ways to achieve quality assurance programmes in the area of processing. (author).

49686 (BIR–18, pp. 97-99) **Sensitometric and densitometric methods for quality control of medical X-ray images.** Vieth, G. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)). British Inst. of Radiology, London (UK); Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development; Commission of the European Communities, Brussels (Belgium). Directorate General for Employment, Social Affairs and Education. 1989. (CONF-8802161–: Workshop on technical and physical parameters for quality assurance in medical diagnostic radiology: tolerances, limiting values and appropriate measuring methods, Brussels (Belgium), 23-25 Feb 1988; EUR–11620). In *Technical and physical parameters for quality assurance in medical diagnostic radiology: Tolerances, limiting values and appropriate measuring methods.* Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The processing of X-ray film is controlled by samples that are exposed to light in a sensitometer. The light exposure is affected by an uncertainty of approximately $\Delta D = \pm 0.12$ and so the limiting value of processing $\Delta D = \pm 0.2$ is reduced (to approximately $\Delta D = \pm 0.16$). The sensitometer itself should also be checked. The uncertainty of simple densitometers is approximately 2% if the instruments are calibrated. The limiting value of the checking for constancy of the X-ray equipment, $\Delta D = \pm 0.2$, interferes with that of processing and can therefore be doubled in extreme cases. The density variation in processing should be as small as possible when constancy is checked. (author).

49687 (DOE/ER/60418–2) **Nuclear medicine and quantitative imaging research (instrumentation and quantitative methods of evaluation): Progress report, January 15–September 1, 1990.** Beck, R.N.; Cooper, M.D. Franklin McLean Memorial Research Inst., Chicago, IL (USA). Sep 1990. 32p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER60418. Order Number DE90017602. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report summarizes goals and accomplishments of the research program supported under DOE Grant No. FG02-86ER60418 entitled Instrumentation and Quantitative Methods of Evaluation, with R. Beck, P. I. and M. Cooper, Co-P.I. during the period January 15, 1990 through September 1, 1990. This program addresses the problems involving the basic science and technology underlying the physical and conceptual tools of radioactive tracer methodology as they relate to the measurement of structural and functional parameters of physiologic importance in health and disease. The principal tool is quantitative radionuclide imaging. The overall objective of this program is to further the development and transfer of radiotracer methodology from basic theory to routine clinical practice in order that individual patients and society as a whole will receive the maximum net benefit from the new knowledge gained. The focus of the research is on the development of new instruments and radiopharmaceuticals, and the evaluation of these through the phase of clinical feasibility. 7 figs.

49688 (DOE/ER/60438–2) **Nuclear medicine and imaging research (quantitative studies in radiopharmaceutical science): Progress report, January 1–September 1, 1990.** Cooper, M.D.; Beck, R.N. Franklin McLean Memorial Research Inst., Chicago, IL (USA). Sep 1990. 59p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER60438. Order Number DE90017604. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This is a report of progress in Year Two (January 1, 1990–December 31, 1990) of Grant FG02-86ER60438, "Quantitative Studies in Radiopharmaceutical Science," awarded for the three-year period January 1, 1989–December 31, 1991 as a competitive renewal following site visit in the fall of 1988. This program addresses the problems involving the basic science and technology underlying the physical and conceptual tools of radioactive tracer methodology as they relate to the measurement of structural and functional parameters of physiologic importance in health and disease. The principal tool is quantitative radionuclide imaging. The overall objective of this program is to further the development and transfer of radiotracer methodology from basic theory to routine clinical practice in order that individual patients and society as a whole will receive the maximum net benefit from the new knowledge gained. The focus of the research is on the development of new instruments and radiopharmaceuticals, and the evaluation of these through the phase of clinical feasibility. 25 refs., 13 figs., 1 tab.

49689 (EUR–12522, pp. 261-272) **Clinical possibilities of neutron capture therapy.** Dewit, L. (Antoni van Leeuwenhoek Ziekenhuis, Amsterdam, (NL). Afdeling Radiotherapie). Commission of the European Communities, Luxembourg (Luxembourg). 1989. (CONF-8904378–: HFR Colloquium, PETTEN (Netherlands), 20-21 Apr 1989). In *Prospects and future utilization.* Order Number DE91702056. Source: NTIS (US Sales Only), PC A18/MF A01.

The idea of utilizing low energy neutrons for treatment of cancer was generated already in 1936, 4 years after the discovery of the neutron. The principle is that thermal neutrons are captured by nuclei, which have a large cross-section. Good candidates for such neutron capture are ^{10}B, ^{6}Li, ^{157}Ga and ^{235}U, ^{10}B has, thus far, been the atom of first choice. The first clinical studies were performed in 1951 at the Brookhaven National Laboratory and at the Massachusetts Institute for Technology in the United States. These trials have been a failure mainly due to the lack of availability of boron compounds which were selectively taken up by the tumor. Hence, exceedingly high doses were delivered to normal tissue compartments, in particular the endothelium and the superficial brain tissue. With the development of more tumor-specific boronated drugs, a renewed interest has been generated in Boron Neutron Capture Therapy (BNCT) in recent years.

49690 (INIS-mf–12110) **Results and hazards of postoperative radiotherapy using orthovoltage (300 kV) in carcinomas of the breast.** Antonopoulos, K. Freie Univ. Berlin (Germany, F.R.). Mar 1984. 74p. (In German). Order Number DE90706210. Source: NTIS (US Sales Only), PC A04/MF A01 - OSTI.

A total of 338 bearers of mammary carcinomas treated between 1971 and 1980 were included in this study and analysed for survival times, metastisation, local relapses and radiation-related hazards so as to permit the results of radiotherapy using hard X-rays (300 kV) to be evaluated and compared to those achieved with other methods of irradiation. In all, it was concluded that the method under investigation did not significantly alter the survival times given for those patients in the relevant literature. As far as the occurrence of local relpases and radiation hazards is concerned, it appears to be marginally better than other techniques.

49691 (INIS-mf–12113) **The role of CT in follow-up treatment of patients after proctectomy due to a carcinoma: A**

retrospective study of 93 patients. Oellinger, R. Freie Univ. Berlin (Germany, F.R.). 24 Oct 1986. 92p. (In German). Order Number DE90706212. Source: NTIS (US Sales Only), PC A05/MF A01 - OSTI.

The results of the thesis explain the unquestionable value of computed tomography as a method for follow-up treatment. Given a suitable timing of CT examinations, and due consideration of additional information obtained e.g. by CEA assays, early detection of local recurrences is possible.

49692 (INIS-mf-12114) **Investigation of the permeation of radiocontrast agent into the experimentally irritated stratum corneum.** Schreiner-Skottke, G. Freie Univ. Berlin (Germany, F.R.). 9 Dec 1986. 87p. (In German). Order Number DE90706211. Source: NTIS (US Sales Only), PC A05/MF A01 - OSTI.

The thesis is a comparative study of the permeation of X-ray contrast medium into the stratum corneum of normal skin and of chemically affected skin in man.

49693 (IPEN-PUB-294) **Isolation and purification of rabbit imunoglobulin (IgG) for the production of a second antibody for radioimunoassay.** Silva, S.R. da; Borghi, V.C. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Mar 1990. 20p. (In Portuguese). Order Number DE91602119. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Immunoglobulin (IgG) from rabbit serum was isolated and purified by sodium sulphate precipitation followed by ion exchange chromatography on DEAE-cellulose. The efficiency of the procedure was followed by total protein determination during all purification steps. The purity of the final product was verified through immunoelectroforesis of IgG with sheep serum anti-rabbit whole serum. Were obtained 850 mg of pure IgG, enough for the immunization of several sheeps to be used in the production of a second antibody for radioimmunoassay. (author).

49694 (STD-87-25) **Assessment of a Shimadzu/medical X-ray supplies basic radiographic installation.** Department of Health, London (UK). Supplies Technology Div. Dec 1987. 62p. Source: Available from The British Library, Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ. Price Pound 25.00.

This report covers the assessment of a basic radiographic installation of Shimadzu equipment comprised of a 50 KW 2 pulse single phase generator, floating top bucky table, floor to ceiling tube support and chest stand purchased in contract year 1985/6. This assessment has demonstrated that the equipment is capable of carrying out an extensive range of examinations satisfactorily. (author).

49695 (STD-87-26) **Assessment of a Siemens basic radiological installation.** Department of Health, London (UK). Supplies Technology Div. Nov 1987. 59p. Source: Available from The British Library, Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ. Price Pound 25.00.

This report covers the assessment of a basic radiographic installation of Siemens equipment comprised of a 30kW 3 phase, medium frequency mean DC output generator, floating top bucky table, floor to ceiling tube support and chest stand purchased in contract year 1985/6. This assessment has demonstrated that the equipment is capable of carrying out an extensive range of examinations satisfactorily although the lack of any tilt for the cassette carriage of the vertical cassette stand imposed a limitation on examinations which require that facility to be available. (author).

49696 (STD-87-39) **Assessment of the Hitachi Sirius 125 B mobile X-ray Unit at three hospitals.** Department of Health, London (UK). Supplies Technology Div. Dec 1987. 41p. Source: Available from The British Library, Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ. Price Pound 10.00.

This report is based on the in-service assessment of the Hitachi Sirius 125B mobile X-ray Unit in 3 NHS hospitals. The unit has been used for a wide range of examinations and has received commendation from all users for image quality, output constancy and reliability. Criticisms have been made of certain operating features which include: (1) there is no interlock to prevent exposure if the state of charge of the capacitors is not sufficient for the factors selected. The usual green ready light is not provided and (2) the longgn wheel base makes manoeuvering in confined spaces difficult. The driving batteries must be kept fully charged to provide adequate power but the battery charge level indication lacks the means of ensuring this. The general performance of this unit for the competitive price at which it is offered by SMR makes it good value. (author).

49697 (STD-88-29) **Report on the use of the Palomex Vision One (Alpha-III) mammographic unit for breast cancer screening.** Department of Health, London (UK). Supplies Technology Div. Aug 1989. 43p. Source: Available from The British Library, Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ. Price Pound 25.00.

Revised version.

A report is given on the use of the Palomax Vision One mammographic unit for breast cancer screening. The report covers installation information, a technical assessment of the high voltage generator, source image receptor and patient positioning and a clinical assessment including comments from radiographers, design features, film processing record, equipment reliability, radiologists' report and mammographic phantom tests. (U.K.).

49698 (STD-89-19) **Report on the use of the Senographe 600TS (SENIXHF) mammographic unit for breast cancer screening.** Department of Health, London (UK). Supplies Technology Div. Aug 1989. 34p. Source: Available from The British Library, Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ. Price Pound 25.00.

A report is given on the use of Senographe 600TS mammographic unit for breast cancer screening. The report covers the description of the equipment, installation information, the technical assessment of the high voltage generator, source image receptor, patient positioning, film markers and safety features and a clinical assessment including radiographers' comments, equipment reliability and radiologists' report. (U.K.).

49699 Characterization of a whole body imaging technique for PET. Guerrero, T.M. (California Univ., Los Angeles, CA (USA). Div. of Nuclear Medicine); Hoffman, E.J.; Dahlbom, M.; Cutler, P.D.; Hawkins, R.A.; Phelps, M.E. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA)*, 37(2): 676-680 (Apr 1990). (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

An investigation of rapid whole-body PET scanning was performed with a view towards its eventual use in screening for metastatic lesions with ^{18}F-fluoride ion or ^{18}F-fluorodeoxyglucose (FDG). This paper presents longitudinal images of the body were formed using three techniques: simple 2-D projection images were formed by resorting the sinogram data. The images were created for a set of angles covering a full 180° to facilitate viewing in a cine format. The effects of summing over a number of angles per view and filtering to reduce noise were investigated. Limited-angle backprojection images were formed using a small range of angles and no reconstruction filter. The resulting volume was then sliced coronally to give planar images as a function of depth. Coronal images were also obtained after reconstruction with a standard filtered backprojection technique, but with no attenuation correction. All three processes provided surprisingly good images of diagnostic quality, which were obtainable in practical scan times.

49700 A study of data loss and mispositioning due to pileup in 2-D detectors in PET. Germano, G. (California Univ., Los Angeles, CA (USA). Div. of Nuclear Medicine); Hoffman, E.J. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA)*, 37(2): 671-675 (Apr 1990). (CONF-900143--: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

This paper reports the effect of event pileup investigated with a PET system which employs a 2-d detector-array system. Event pileup caused losses of resolution of 9%, 19.8% and 32% of the FWHM for 10, 20 and 30 mCi of positron emitter in the field of view (FOV), respectively. 9.4%, 18.7% and 28.1% of the data from the outer planes of the module were incorrectly placed in the inner

planes for 5, 10, and 15 mCi of positron emitter in the FOV, respectively. A simple model of the process was formulated and was found to be adequate to describe the major features of event pileup for a number of source configurations and a wide range of activities.

49701 3-D phantom to simulate cerebral blood flow and metabolic images for PET. Hoffman, E.J. (California Univ., Los Angeles, CA (USA). Nuclear Medicine Lab.); Cutler, P.D.; Digby, W.M.; Mazziotta, J.C. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 616-620 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

A 3-dimensional brain phantom has been developed to simulate the activity distributions found in the human brain in the cerebral blood flow and metabolism studies currently employed in PET. The phantom has a single contiguous chamber and utilizes thin layers of lucite to provide apparent relative concentrations of 5, 1 and 0 for gray matter, white matter and ventricles, respectively, in the brain. The phantom and an ideal image set were created from the same set of data. Thus, the user has a basis for comparing measured images with an ideal image set which enables the user to make quantitative evaluation of the errors in PET studies with a data set similar to that obtained in patient studies.

49702 The feasibility of images reconstructed with the method of sieves. Veklerov, E. (Lawrence Berkeley Lab., CA (USA). Engineering Div.); Llacer, J. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(2): 835-841 (Apr 1990). DOE Contract AC03-76SF00098. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The concept of sieves has been applied with the maximum likelihood estimator (MLE) to image reconstruction. While it makes it possible to recover smooth images consistent with the data, the degree of smoothness provided by it is arbitrary. It is shown that the concept of feasibility is able to resolve this arbitrariness. By varying the values of parameters determining the degree of smoothness, one can generate images on both sides of the feasibility region, as well as within the region. Feasible images recovered by using different sieve parameters are compared with feasible results of other procedures. One- and two-dimensional examples using both simulated and real data sets are considered.

49703 Three-dimensional imaging utilizing energy discrimination. Gunter, D.L. (Franklin McLean Memorial Research Institute, Dept. of Radiology, Univ. of Chicago, IL (US)); Hoffman, K.R.; Beck, R.N. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA),* 37(3): 1300-1307 (Jun 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

An algorithm is proposed for three-dimensional image reconstruction in nuclear medicine which uses scattered radiation rather than multiple projected images to determine the source depth within the body. Images taken from numerous energy windows are combined to construct the source distribution in the body. The gamma-ray camera is not moved during the imaging process. Experiments with both Tc-99m and Ga-67 demonstrate that two channels of depth information can be extracted from the low energy images produced by scattered radiation. By combining this technique with standard SPECT reconstruction using multiple projections the authors anticipate much improved spatial resolution in the overall three-dimensional reconstruction.

5508 Morphology

Refer also to citation(s) 49588

5509 Pathology

Refer also to citation(s) 49655

5510 Physiological Systems

49704 (LA-UR–90-2562) **Oscillation onset in neural delayed feedback.** Longtin, A. Los Alamos National Lab., NM (USA). [1990]. 7p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-901150–2: IEEE conference on neural information processing: natural and synthetic, Denver, CO (USA), 26-29 Nov 1990). Order Number DE90015057. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper studies dynamical aspects of neural systems with delayed negative feedback modelled by nonlinear delay-differential equations. These systems undergo a Hopf bifurcation from a stable fixed point to a limit cycle oscillation as certain parameters are varied. We show that their frequency of oscillation is robust to parameter variations and noisy fluctuations, a property that makes these systems good candidates for pacemakers. The onset of oscillation is postponed by both additive and parametric noise in the sense that the state variable spends more time near the fixed point. Finally, we show that a distributed delay (rather than a fixed delay) also stabilizes the fixed point solution. 40 refs., 2 figs.

5530 Agriculture and Food Technology

Refer also to citation(s) 48819

49705 (NIRS-RSD–89) **Radioactivity survey data in Japan, part 2: Dietary materials.** National Inst. of Radiological Sciences, Chiba (Japan). Mar 1990. 30p. Order Number DE90520441. Source: NTIS (US Sales Only), PC A03/MF A01.

The publication is aimed at providing radioactivity survey data in environmental and dietary materials in Japan. Part 2 gives dietary materials, consisting of total diet, rice, milk, vegetables, sea fish, freshwater fish, shellfish, and seaweeds. Samples were collected from 37 sampling locations during the period between August 1988 and March 1989, and were sent to the Japan Chemical Analysis Center for radiochemical analysis. Strontium-90 and cesium-137 in these dietary materials are tabulated. The maximum concentrations of strontium-90 and cesium-137 were as follows: 0.12±0.012 Bq/p·d and 0.16±0.012 Bq/p·d, respectively, for total diet; 0.0000±0.0084 Bq/Kgwet and 0.42±0.019 Bq/Kgwet for rice (producing districts); 0.0000±0.0084 Bq/Kgwet and 0.048±0.0091 Bq/Kgwet for rice (consuming districts); 0.059±0.008 Bq/l and 0.26±0.013 Bq/l for milk (producing districts for domestic program); 0.14±0.013 Bq/l and 0.19±0.011 Bq/l for milk (producing districts for WHO program); 0.057±0.008 Bq/l and 0.15±0.010 Bq/l for milk (consuming districts); 0.97±0.032 Bq/Kgwet and 0.062±0.010 Bq/Kgwet for vegetables (producing districts); 0.52±0.024 Bq/Kgwet and 0.051±0.009 Bq/Kgwet for vegetables (consuming districts); 0.043±0.010 Bq/Kgwet and 0.34±0.017 Bq/Kgwet for sea fish; 0.96±0.032 Bq/Kgwet and 0.066±0.009 Bq/Kgwet for freshwater fish; 0.017±0.019 Bq/Kgwet and 0.027±0.011 Bq/Kgwet for shellfish; and 0.031±0.011 Bq/Kgwet and 0.12±0.10 Bq/Kgwet for seaweeds. Yearly changes in the concentrations of both strontium-90 and cesium-137 from 1985 through 1989 are given in figures. (N.K.).

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

Refer also to citation(s) 49004

5601 Radiation Effects

Refer also to citation(s) 48487, 48652, 49150, 49151, 49546, 49548, 49610

49706 (AD-A–222647/0/XAB) **Preparation of potential radioprotective agents derived from aminothiols. Annual report, 16 July 1985-15 July 1986.** Ternay, A.L. Texas Univ., Arlington, TX (USA). Dept. of Chemistry. Sep 1985. 45p. Contract DAMD17-84-C-4137. Source: NTIS, PC A03/MF A01.

The purpose of this program is to prepare substances containing known (and potentially) radioprotective fragments bound to small biomolecules. They are to be prepared in small quantities. These

compounds are then to be submitted for biological evaluation. The method chosen to link the radioprotective fragment (usually an aminothiol) to the biomolecule is to join them via a disulfide bond (-S-S-). During much of this year particular emphasis has been placed upon the synthesis of potential radioprotective steroids. Two very different methodologies have been used for the synthesis of unsymmetric disulfides. One involves the reaction of a thiol with the thiolsulfinate derived from a different thiol. This method has the potential for producing the desired (target) compound in high purity with a minimum of side products. During the reporting fifteen (15) compounds were submitted for biological evaluation. Seven of these are steroid-containing substances, two are phenothiazines and three are polymer-bound materials. The latter contain a radioprotective agent (e.g., WR-1065) bound to a polymer by an ionic bond. The polymer which was used was the commercially-available Dowex 50W-X8, an ion-exchange resin containing free sulfonic acid residues.

49707 (AD-A–222722/1/XAB) **Survival of Chinese hamster ovary cells following ultrahigh-dose-rate electron and bremsstrahlung radiation. Final report, September 1988-February 1989.** Holahan, P.K.; Meltz, M.L. Texas Univ., San Antonio, TX (USA). Health Science Center. Apr 1990. 13p. Contract F33615-87-D-0626. Source: NTIS, PC A03/MF A01.

The objective of this research was to measure cellular effects of ultrahigh dose rate X rays associated with high-power microwave devices. The intent was to detect differences in effect of ultrahigh dose-rate X rays compared to conventional dose-rate X rays at equivalent total doses. Cell survivability was used as the measure. No differences were noted until a dose of 4 Gray or greater was achieved.

49708 (AD-A–222880/7/XAB) **Effects of ionizing radiation on the performance of selected tactical combat crews. Technical report, 12 March 1986-30 October 1987.** Dore, M.A.; Anno, G.H. Pacific-Sierra Research Corp., Los Angeles, CA (USA). 1 May 1990. 138p. Contract DNA001-85-C-0352. (PSR–1846). Source: NTIS, PC A07/MF A01.

A general model is developed for characterizing the expected performance of four selected types of tactical army combat crews when the individual crewmembers function at degraded performance levels due to acute exposure to ionizing radiation. The model is also applicable to other situations that degrade individual crewmember performance. The results provide performance data for larger scale U.S. Army models that simulate battlefield conflicts where nuclear weapons might be employed. Performance-level data are generated as a function of dose and time after exposure for each crew type.

49709 (AD-A–955922/0/XAB) **Mechanism of action of radiation-protective agents: in-vivo distribution and metabolism of cysteamine-S-phosphate (MEAP). Annual report, 1 July 1968-30 June 1969.** Shapiro, B.; Kollman, G. Albert Einstein Medical Center, Philadelphia, PA (USA). Radiation Research Lab. 30 Jun 1969. 27p. Contract DADA17-67-C-7165. Source: NTIS, PC A03/MF A01.

The appearance of a new class of protective agents, the aminoalkyl-thio-phosphates (or aminoalkyl-phosphorothioates), provided the opportunity to re-evaluate these proposed mechanisms of action. The new compounds are less toxic than the aminoalkylthiols and provide equal or better protection. A study of the distribution and metabolism of one of these agents, aminoethylthiophosphate or cysteamine-S-phosphate (MEAP) was undertaken to test the hypotheses arrived at in the mechanism studies of mercaptoethylguanidine and bis(2-guanidoethyl) disulfide. In this study, the protective agent MEAP labelled with P-32 and S-35 was analyzed in pure solutions, in homogenates of mouse tissues in vitro and in homogenates of tissues from mice given protective doses of MEAP in vivo. A small radiation mortality study was run concurrently with the distribution and metabolism studies in order to be sure that the analyzed mice were really being studied under conditions of protection.

49710 (AERE-R–12810) **Uranium and human diet: a literature review.** Long, S.E. UKAEA Harwell Lab. (UK). Environmental and Medical Science Div. Dec 1987. 30p. Source: Available from H.M. Stationery Office, London, price Pound 10.00.

Uranium is present in the environment from industrial activities, nuclear power generation and from primordial sources. This report discusses a survey of the literature of the occurrence of uranium in the foodchain and human diet. The dietary absorption and human metabolism of uranium present in foodstuffs are discussed. (author).

49711 (ANS-R–598-2) **Incorporation of experimental data, review and documentation of the SPADE database.** Coughtrey, P.J.; Cramp, T.J.; Grezo, C.A.B.; Kirton, J.A.; Mitchell, N.G. Associated Nuclear Services, Epsom (UK); Ministry of Agriculture, Fisheries and Food, London (UK). Aug 1987. 155p. Project MAFF 410;ANS Job 598. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Animal models used in the SPADE suite of codes are reviewed. This review covers models originally specified and their current form. Recommendations made in "Radionuclide Distribution and Transport in Terrestrial and Aquatic Ecosystems" are also considered. Elements included in the review are Cs, Ce, I, Pu, Ru, Sr and Te. A review of nuclide independent default parameters is undertaken, including stable iodine ingestion, soil ingestion, edible plant yields, grazing areas and consumption rates of feed. Values of rate coefficients obtained from experimental work are presented, together with Ce, Ru, Sr and Cs values of rate coefficients for transfers from soil to root, root to shoot and soil to shoot for Lolium perenne grown on Sizewell soil and Mendip loam. For Ce, Sr and Cs values of rate coefficients for transfer in Sizewell soil and Mendip loam and for Ru values of rate coefficients for transfers in Mendip loam are presented. (Author).

49712 (IAEA-R–4297-F) **Retention of alkaline earth elements in man: Final report for the period 1 April 1986 - 14 May 1989.** Newton, D. UKAEA Harwell Lab. (UK); International Atomic Energy Agency, Vienna (Austria). Jun 1990. 67p. Order Number DE90636742. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

The data on human metabolism and long-term retention of alkaline earth elements (^{133}Ba injected into six healthy male volunteers at age 25-81 y and ^{45}Ca and ^{85}Sr received by one healthy male volunteer) are presented. Excreta were collected for 2-3 weeks after injection of the tracer into an antecubital vein. Activity in urine, ashed faeces and early samples of blood plasma was determined by gamma-ray scintillation spectrometry. Whole body retention has been assessed through serial measurements of body radioactivity. The injected ^{133}Ba apparently became mainly skeletal within several days, much earlier than predicted by the ICRP model. The whole-body retention at 32 d ranged from 5 to 14%, the rate of loss correlating with the excretory plasma clearance rate. No age-related trends were identified in the metabolism of Ca and Sr. 2 refs, 2 figs.

49713 (IPEN-PUB–174) **"In vitro" and "in vivo" studies 2,6 - diisopropyl-fenil-carboilmethyl iminodiacetic acid labeled with^{99m}Tc (Disida -^{99m}Tc).** Martinez, D.Y.F.; Barbosa, M.R.F.F. de; Muramoto, E.; Achando, S.S.; Silva, C.P.G. da. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Jul 1988. 11p. (In Portuguese). Order Number DE90639714. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The "in vivo" and "in vitro" studies on DISIDA -^{99m}Tc at the hepatobiliary level were made. The binding of DISIDA -^{99m}Tc to plasmatic proteins and the fraction at which this binding occurs were determined. The distribution coefficient in n-octanol/saline solution was 0.41 showing the lipophilicity of the compound. The images in rats show the biological distribution as well as the hepatobiliary clearance of the radiopharmaceutical under its unmetabolized form. (author).

49714 (JAERI-M–90-076) **Isolation and properties of plasmids from Deinococcus radiodurans Sark.** Sjarief, S.H. (National Atomic Energy Agency, Jakarta (Indonesia)); Kikuchi, Masahiro; Kurita, Hiromi; Kitayama, Shigeru; Watanabe, Hiroshi. Japan Atomic Energy Research Inst., Tokyo (Japan). May 1990.

20p. Order Number DE90520219. Source: NTIS (US Sales Only), PC A03/MF A01.

Radioresistant bacterium, Deinococcus radiodurans, can repair completely almost all of DNA damages including double strand breaks induced by gamma-rays up to about 5 kGy. In order to reveal the repair mechanism, it is necessary to develop a cloning vector available for the genetic analysis. We tried to isolate plasmids from D.radiodurans Sark strain. In the present paper the isolation and properties of plasmids were described. (author).

49715 (MIC–90-03615/XAB) **Health effects of ionizing radiation.** Pathak, B. Canadian Centre for Occupational Health and Safety, Hamilton, ON (Canada). ©1989. 24p. (SSC-CC–273-2/89-27E). Source: NTIS, PC EE07/MF E01.

This publication provides basic information on the possible health hazards of ionizing radiation. The publication includes a definition of ionizing radiation, the sources and types, occurrences of internal and external exposure, definitions of dose levels, the health effects, effects of exposure including genetic effects, combined exposures of ionizing radiation and chemicals, and acceptable doses. A glossary of technical terms is included.

49716 (N–90-25031) **Improved model for solar cosmic ray exposure in manned Earth orbital flights.** Wilson, J.W.; Nealy, J.E.; Atwell, W.; Cucinotta, F.A.; Shinn, J.L.; Townsend, L.W. National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center. Jun 1990. 14p. (NASA-TP–2987;L–16759;NAS–1.60:2987). Source: NTIS, PC A03/MF A01.

A calculational model is derived for use in estimating Solar cosmic ray exposure to critical body organs in low-Earth orbit at the center of a large spherical shield of fixed thickness. The effects of the Earth's geomagnetic field and the astronauts' self-shielding are evaluated explicitly. The geomagnetic field model is an approximate tilted eccentric dipole with geomagnetic storms represented as a uniform-impressed field. The storm field is related to the planetary geomagnetic index K(sub p). The code is applied to the Shuttle geometry using the Shuttle mass distribution surrounding two locations on the flight deck. The Shuttle is treated as pure aluminum and the astronaut as soft tissue. Short-term, average fluence over a single orbit is calculated as a function of the location of the lines of nodes or long-term averages over all lines of nodes for a fixed inclination.

49717 (RERF-TR–4-90) **Frequency of malignant tumors during the first two decades of life in the offspring (F_1) of atomic bomb survivors.** Yoshimoto, Yasuhiko; Neel, J.V.; Kato, Hiroo; Mabuchi, Kiyohiko; Schull, W.J.; Soda, Midori; Eto, Ryozo. Radiation Effects Research Foundation, Hiroshima (Japan). May 1990. 25p. Order Number DE90520241. Source: NTIS (US Sales Only), PC A03/MF A01.

The incidence of cancer prior to age 20 has been determined in children born to atomic bomb survivors and to a suitable comparison group. Tumor ascertainment was through death certificates and the tumor registries maintained in Hiroshima and Nagasaki. The rationale for the study stemmed from the evidence that a significant proportion of childhood tumors such as retinoblastoma and Wilms' tumor arise on the basis of a mutant gene inherited from one parent plus a second somatic cell mutation involving the allele of this gene. Gonadal radiation doses were calculated using the recently established DS86 system, supplemented by an ad hoc system for those children whose parents' (one or both) DS86 dose could not be computed but for whom a dose could be developed on the basis of the available information. The total data set consisted of: (1) a cohort of 31,150 liveborn children, one or both of whose parents received $\geq$ 0.01 Sv of radiation at the time of the A-bombings (an average conjoint gonad exposure of 0.435 Sv), and (2) two suitable comparison groups, totaling 41,066 children. A total of 92 cancer cases at age less than 20 years was confirmed; 49 and 43 cases, respectively, in the 0 Sv and $\geq$ 0.01 Sv groups. A multiple linear regression analysis revealed no increase in malignancy in the children of exposed parents. However, examination of the data suggested that only 3.0 % to 5.0 % of the tumors of childhood observed in the comparison groups are associated with an inherited genetic predisposition that would be expected to exhibit an altered frequency if the parental mutation rate were increased. These is thus far no confirmation of the positive findings of Nomura in a mouse system. (author).

5603 Chemicals Metabolism and Toxicology

Refer also to citation(s) 48123, 48154, 48159, 48161, 48774, 48841, 49151, 49409, 49410, 49411, 49465, 49533, 49534, 49535, 49536, 49537, 49538, 49539, 49548, 49567, 49582, 49614, 49615, 49616, 49617, 49619, 49620, 49621, 49622, 49623, 49624, 49625, 49626, 49627, 49632

49718 (MIC–90-03624/XAB) **Beryllium disease: A summary of the occupational health concern.** Bertolini, R. Alberta Public Safety Services, Edmonton, AB (Canada). ©1989. 9p. (SSC-CC–273-2/89-23E). Source: NTIS, PC EE07/MF E01.

Beryllium is a metal widely used in industry because of its light weight, high melting point, high strength, and good electrical conductivity. Exposure to the fumes and dusts of beryllium and its compounds or alloys causes various diseases that affect several organs of the body. This report describes the industrial uses of beryllium; the acute and chronic phases of the disease; diagnosis and treatment; and prevention.

49719 (PB–90-245069/XAB) **Inhalation toxicology of combined acid and soot particles. Final report.** Phalen, R.F.; Kleinman, M.T. California Univ., Irvine, CA (USA). Dept. of Community and Environmental Medicine. Apr 1989. 56p. Contract ARB-A5-129-33. Source: NTIS, PC A04/MF A01.

As a result of a request by the California Air Resources Board for proposals dealing with fine particles, an innovative inhalation toxicology study, using a reliable animal model, was designed and successfully conducted. The objective of the study was to evaluate the respiratory system toxicity of both diesel-engine-generated and propane-flame-generated fine carbon particles, especially when an acid mixture of the type observed in California's air was also present. Atmospheres were generated into stainless-steel exposure chambers and healthy rats breathed the pollutants nose-only for 5 hours per day for 5 consecutive days. The atmospheres studied included dilute diesel exhaust soot + nitric acid + sulfuric acid, and propane-flame-generated carbon soot + nitric acid + sulfuric acid. Groups of rats were also exposed to the nitric and sulfuric acid mixture, diesel soot, or propane soot in order to examine the effects of the components of the soot + acids mixtures. Controls for exposure were rats exposed using the same schedule to purified air.

49720 (PB–90-245077/XAB) **Acid air pollutant mixtures: Respiratory system responses and effects of exercise.** Mautz, W.J.; Kleinman, M.T.; Finlayson-Pitts, B. California Univ., Irvine, CA (USA). Dept. of Community and Environmental Medicine. Oct 1989. 141p. Contract ARB-A6-148-33. Source: NTIS, PC A07/MF A01.

The study involved evaluation of rats exposed (at rest or while exercising) via a nose-only exposure system to various combinations of pollutants. The duration of exposure was four hours. The effects of O3 alone were compared to a combination of O3, HNO3 and H2SO4 and to a combination of O3 and HMSA. The comparisons were made at two concentration levels. Target concentrations for the lower levels were 0.20 ppm O3, 0.50 mg/cu m HNO3, 0.25 mg/cu m H2SO4 and 0.25 mg/cu m HMSA while higher concentration levels were twice these values. The toxic effects evaluation included: (1) Pulmonary function measures consisting of breathing frequency, tidal volume, minute ventilation, oxygen consumption, ventilation equivalent for oxygen and body temperature; (2) Histopathological analysis of nasal and lung epithelium which included: (a) microscopic analysis of nasal and lung tissue sections for qualitative analysis of injury and quantifying the injury as lesion areas; and (b) measurement of cell turnover by autoradiography as evidence of injury to the lining epithelium; (3) Biochemical analysis of pulmonary surfactant (PS) by Fourier transform infrared spectrometry (FTIR), ultraviolet spectrometry and gas chromatographic analysis for fatty acid composition of the PS.

49721 (PB–90-247347/XAB) **Influence of experimental pulmonary emphysema on toxicological effects from inhaled nitrogen dioxide and diesel exhaust. Research report, January 1984-September 1987.** Mauderly, J.L.; Bice, D.E.; Cheng, Y.S.;

Gillett, N.A.; Henderson, R.F. Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA). ©Feb 1990. 61p. Source: NTIS, PC A04/MF A01.

The hypothesis tested in the project was that rats with preexisting experimentally-induced pulmonary emphysema were more susceptible than rats with normal lungs to the adverse effects of exposure to NO(sub 2) or diesel exhaust. Rats were exposed by inhalation seven hr/day, five day/wk, for 24 months to NO(sub 2) at 9.5 ppm, or to diesel exhaust at 3.5 mg soot/cu m, or to clean air. Pulmonary emphysema was induced in one-half of the rats by intratracheal instillation of elastase, six weeks before exposures. Nonneoplastic endpoints were evaluated after 12, 18, and 24 months of exposure. Nitrogen dioxide exposure of normal rats caused mild epithelial hyperplasia and inflammation in proximal alveoli. Significant interactions between the influences of emphysema and nitrogen dioxide were demonstrated to be additive for four parameters (out of 61 parameters). Diesel-exhaust exposure of normal rats caused progressive, focal inflammation, and epithelial proliferation. The final soot lung burden was only one-third of that in nonemphysematous lungs.

49722 (PB–90-248915/XAB) **Integrated criteria document: Asbestos effects. Appendix.** Montizaan, G.K.; van der Heijden, C.A. Rijksinstituut voor Volksgezondheid en Milieuhygiene, Bilthoven (Netherlands). May 1989. 130p. (RIVM–758473013). Source: NTIS, PC A07/MF A01.

See also PB–90-248907. North American Continent sales only. All others National Institute of Public Health and Environmental Protection, P.O. Box 1, 3720 BA Bilthoven, The Netherlands.

Asbestos is a general term applied to certain fibrous forms (asbestiform varieties) of silicate minerals, with long thin separable fibers or fibrils possessing high tensile strength and flexibility. Current use of the term asbestos is restricted to six fibrous silicates: chrysotile, crocidolite, amosite, anthophyllite, tremolite and actinolite. There are many other asbestiform minerals, with crystal-forming properties similar to asbestos, that occur naturally. They usually do not possess the same physical-chemical properties as asbestos, and hardly ever occur in sufficient quantities for exploitation. Examples of commercially applied asbestiform minerals are attapulgite and sepiolite. There are also many asbestiform man-made materials, e.g. glass wool, rock wool, ceramic fibers. The focus of the document will be on asbestos; some attention will be paid to non-asbestos fibrous materials, but the reviewed literature on the latter subject is not exhaustive.

49723 (PB–90-252636/XAB) **Pilot study on international information exchange on dioxins and related compounds. Final report, 1985-1989.** McNelis, D.N.; Bretthauer, E.W.; Kutz, F.W.; Bottimore, D.P.; Duda, S.W. North Atlantic Treaty Organization, Brussels (Belgium). Committee on the Challenges of Modern Society. Dec 1989. 646p. Contract EPA-68-D9-0166. (NATO/CCMS–170). Source: NTIS, PC A99/MF A04.

Portions of this document are not fully legible.

The Pilot Study on International Information Exchange on Dioxins and Related Compounds was initiated in 1985 to apply the cooperative efforts of numerous nations to address the problems associated with CDDs, CDFs, and related compounds. The Pilot Study conducted activities to examine exposure and risk assessment, technology assessment, and management of accidents involving these compounds. One of the activities of the Pilot Study was to compile, analyze, and distribute information on research projects addressing these compounds. The report describes some of the research activities that were underway between the years of 1985-1989. The report also contains detailed analyses of funding priorities and research emphasis among NATO nations.

49724 (PB–90-255050/XAB) **Integrated criteria document: PAHs.** Slooff, W.; Janus, J.A.; Matthijsen, A.J.C.M.; Montizaan, G.K.; Ros, J.P.M. Rijksinstituut voor Volksgezondheid en Milieuhygiene, Bilthoven (Netherlands). Nov 1989. 114p. (RIVM–758474011). Source: NTIS, PC A06/MF A01.

U.S., Canada and Mexico sales only. All others refer to National Institute of Public Health and Environmental Protection, P.O. Box 1, 3720 BA Bilthoven, The Netherlands.

The document contains data on polycyclic aromatic hydrocarbons (PAHs) with regard to sources and distribution, risks based on balancing exposure levels and harmful concentrations, the technical possibilities to reduce these risks and the business economic consequences of these measures. The PAH-group consists of several hundreds of organic substances composed of two or more benzene rings which especially receive considerable attention because of their alleged carcinogenic properties.

49725 (PB–90-255068/XAB) **Appendix to Report No. 758474011. Integrated criteria document PAH: Republication of Addendum to Report No. 758474007, March 1989. Effects of 10 selected compounds.** Montizaan, G.K.; Kramers, P.G.N.; Janus, J.A.; Posthumus, R. Rijksinstituut voor Volksgezondheid en Milieuhygiene, Bilthoven (Netherlands). Nov 1989. 196p. Source: NTIS, PC A09/MF A02.

U.S., Canada and Mexico sales only. All others refer to National Institute of Public Health and Environmental Protection, P.O. Box 1, 3720 BA Bilthoven, The Netherlands.

Polynuclear aromatic hydrocarbons (PAHs) are compounds consisting of carbon and hydrogen only, with two or more benzene rings in the molecule. The arenes and alkylated arenes belong to this group, whereas the aza-, imino-, nitro-, carbonyl-, oxa-, thio- and polychloro-arenes do not. The document, part of the Integrated Criteria Document PAH, consists of a detailed evaluation of the effects on man and environment of only 10 PAH, all belonging to the group of arenes. The given selection implies a severe restriction of the toxicological evaluation of PAH, which will be explained. Of all polynuclear aromatic compounds, the arenes are probably not the most harmful ones to man. Many arenes are known to be carcinogenic, however some nitro-arenes have been shown to have a much higher potency for causing genetic damage in mutagenicity tests than the arenes.

49726 Nitrate reductase is induced in red spruce by NO_2 and HNO_3 vapor. Norby, R.J. (Oak Ridge National Lab., TN (USA)); Hanson, P.J.; Weerasuiya, Y. *Plant Physiology, Supplement (USA)*, 89(4): 20 (Apr 1989).

The activity of nitrate reductase (NR) in needles of red spruce (Picea rubens Sarg.) trees is normally very low: 220 $nmol \cdot g^{-1} \cdot h^{-1}$ in 1-year-old nursery-grown seedlings and 47 $nmol \cdot g^{-1} \cdot h^{-1}$ in plants excavated from a high-elevation spruce forest. The assimilation of nitrogen oxide pollutants absorbed from the atmosphere by red spruce trees may, therefore, require that NR is induced in the needles. To test for induction of NR, 1-year-old, nursery-grown red spruce seedlings were exposed to NO_2, HNO_3 vapor, or acid mist containing nitrate, and the activity of NR in needles was measured using an in vivo assay. One day after exposure to NO_2 (75 $nl \cdot l^{-1}$) began, NR activity had increased to 765 $nmol \cdot g^{-1} \cdot h^{-1}$, more than 3 times that of unexposed control plants. During the 7-day exposure, NR activity of the treated seedlings declined 36%, but it remained significantly higher than that of controls. One day after exposure ended, NR activity returned to the control level. Forest-frown seedlings exhibited a similar response to NO_2, but at a much lower level. Nitric acid vapor (75 $nl \cdot l^{-1}$) also induced NR in red spruce needles, and the pattern and magnitude of response were similar to that with NO_2, except that the NR activity did not return to control levels until 2 days after exposure ended. Exposure of seedlings to simulated acid mist containing nitrate (pH 3.5 and pH 5.0) did not result in a significant change in NR activity. These results indicate that red spruce is capable of assimilating NO_2 and HNO_3 vapor, and that hypotheses of forest decline based on foliar assimilation of pollutant nitrogen oxides are tenable.

5604 Other Environmental Pollutant Effects

49727 (HWC/HP–H46-2/89-150E) **Electric and magnetic fields and your health: A report of the Working Group on Electric and Magnetic ELP Fields.** Health and Welfare Canada, Ottawa, ON (Canada). May 1989. 34p. (MICROLOG–90-03856). Source: PC Health and Welfare Canada, Communications Directorate, Brooke Claxton Bldg, Ottawa, ON, CAN K1A 0K9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

Generation, transmission and use of electricity are associated with production of electric and magnetic fields at 60 Hz. People are exposed to these fields not only when they are under high-voltage

lines, but also in their homes, because such field are produced by distribution lines, house wiring and by all electrical appliances and other electrical devices. The available scientific evidence on health effects of these fields is inconsistent and inconclusive. Some epidemiological studies suggest a possible association between increased risks of certain cancers and exposure to magnetic and/or electric fields. Also, some experiments with animals and cells show that these fields can interact with biological systems. It has not been well established, but some of these interactions may have detrimental consequences. Some of the experimental data indicate that a stronger field is not necessarily more dangerous. Some effects occur for weaker fields, but not for stronger ones. Recently an increased research effort has been undertaken with the hope of resolving these health issues. 11 refs., 2 figs.

49728 (MIC–90-03619/XAB) **Radiofrequency radiation in the workplace.** Charron, D. Canadian Centre for Occupational Health and Safety, Hamilton, ON (Canada). ©1989. 21p. (SSC-CC–273-2/89-24E). Source: NTIS, PC EE07/MF E01.

French ed.

Communications, industry and medicine are increasingly using radiofrequency electromagnetic fields, leading to a greater need to understand the known and possible health consequences of exposure to these fields. This publication briefly summarizes the current state of knowledge concerning health effects of exposure to radiofrequency electromagnetic fields. The publication includes definition of radiofrequency electromagnetic radiation, those at risk, the thermal and non-thermal health effects, the safety hazards, the exposure limits, and methods of control or limiting. Summaries of the existing and proposed guidelines are also included.

49729 (OH/RD–89-259-K) **Exposure system for animal studies involving high-level 60-Hz magnetic fields.** Harvey, S.M. Ontario Hydro, Toronto, ON (Canada). Research Div. 27 Oct 1989. 16p. (MICROLOG–90-03521). Source: PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

The design of an animal exposure chamber used in the Ontario Hydro Magnetic-Field Rodent Reproductive Study (MFRRS) has been reviewed and modified for use in studies requiring an exposure to high-strength 60-hertz magnetic fields. New design criteria and specifications are described, and one proposal offered was to obtain the various parts of the chambers from outside suppliers where possible, but to assemble and test the coil driver circuits in-house. 1 ref., 9 figs.

49730 (PNL-SA–18290) **The role of elf field dosimetry and bioeffects mechanisms in relating in vitro to in vivo exposures.** Miller, D.L. Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. (CONF-9006269–1: 12. annual meeting of the bioelectromagnetics society, San Antonio, TX (USA), 10-14 Jun 1990). Order Number DE90017240. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Animal exposures to ELF electric or magnetic fields are typically described in terms of the external field direction and RMS magnitude. Within the animal, the magnetic field exists virtually unperturbed by the body, while the external electric field is greatly attenuated. In addition, electrical fields and currents are induced inside any conducting body exposed to ELF electric or magnetic fields, and these are strongly dependent on the size, shape and conductivity of the object. In vitro, similar considerations apply to the volume of cell suspension, but a greater degree of control is possible in the relative magnitudes of electric field, induced current and magnetic field in the media. The goal of this presentation is to outline general aspects of this interaction and to compare the biophysical dosimetry for animals to the situation which pertains for in vitro experiments. Such information is critical for rational development of exposure systems and selection of appropriate exposure parameters. Since one major objective of in vitro experiments is to simulate the bioeffects situation in vivo, dosimetric information is needed for any extrapolation of laboratory in vitro or animal experimental results to environmental exposures of humans. In addition, this information is needed for the consideration of potential mechanisms of biological effects of ELF fields. 7 refs., 3 figs., 1 tab.

57 HEALTH AND SAFETY

49731 (UCRL-ID–104571) **EE Microfabrication facility toxic gas system: A probabilistic risk assessment using human reliability analysis methods.** Banks, W.W.; Harmon, K. Lawrence Livermore National Lab., CA (USA). Jul 1990. 152p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90018005. Source: NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The focus of this report is narrowly directed at a theoretical hydrogen gas release in an unventilated vault as a result of an accident and the vents and behaviors necessary to allow such an event to propagate into one of high consequence. This report describes the "worst case" probability and effect (consequence) of a human-error-initiated H_2 leak in the Building-153 gas vault. The primary focus and concern of this report is to generate a probability estimate of an H_2 release based upon the likelihood of task-critical human error in combination with hardware/electrical failures. The focus of this paper is narrowly directed at a hydrogen gas release in an unventilated vault as a result of an accident and the antecedent events and behaviors necessary to allow such an event to propagate into high consequence (explosion). The authors of this report believe that the method used to calculate the risk estimate can be generalized to several different types of compressed gas cylinder releases caused by human error. Our approach is therefore intentionally broad to include the anticipated generalizations to other similar situations where the same assumptions and conditions exist. 33 refs., 4 figs.

58 GEOSCIENCES

Refer also to citation(s) 48270, 48272, 48273, 48275, 48276, 48296, 48297, 48307, 48309, 48314, 48316, 48330, 48331, 48333, 48334, 48335, 48336, 48337, 48338, 48339, 48342, 48343, 48479, 49029, 49041, 49129, 49458

49732 (DOE/ER/14057–1) **New approaches to estimation of magnetotelluric parameters: Annual report, 1 August 1989–31 July 1990.** Egbert, G.D. (Oregon State Univ., Corvallis, OR (USA). Coll. of Oceanography); Booker, J.R. Oregon State Univ., Corvallis, OR (USA). Coll. of Oceanography. [1990]. 28p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-89ER14057. Order Number DE90016188. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document proposed the development and application of some new statistical techniques for improving the collection and analysis of wide-band magnetotelluric (MT) data. The principle goal of our work is to develop and implement fully automatic single station and remote reference impedance estimation schemes which are robust, unbiased and statistically efficient. The initial proposal suggested several extensions to the regression M-estimates to better allow for non-stationary and non-Gaussian noise in both electric and magnetic field channels (measured at one or more simultaneous stations). A second goal of the proposal was to develop formal, reliable procedures for estimating undistorted 2-d strike directions and to develop statistics for assessing the validity of the 2-d assumption that are unaffected by near surface static distortion effects. To test and validate the methods, working with data selected from a series of over 200 wide-band MT sites was proposed. For the current budget period, setting up a data base, and completing development and initial testing of the single station and remote reference methods outlined in the proposal is suggested. 8 refs., 13 figs.

49733 (DOE/ER/14064–1) **Two and three dimensional magnetotelluric inversion: Annual progress report.** Washington Univ., Seattle, WA (USA). [1990]. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-89ER14064. Order Number DE90016187. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper is an annual progress report. In prior reporting periods, a numerically efficient algorithm to invert large magnetotelluric (MT) data sets for conductive structures has been developed. The method is iterative and approximates lateral derivatives of the electric and magnetic fields inside the model by their values from the previous iteration. The model is made unique by minimizing a function which measures the complexity of the model. The purpose is to find the model with the least structure for a given level of misfit to the data. The method is called the Rapid Relaxation Inverse (RRI). During the past year, effort has been split between improving the two-dimensional (2D) version of our code and developing a three-dimensional (3D) version. The 2D work has involved a thorough study of synthetic data generated from known models with random noise added. This study resulted in the implementation of three stabilization schemes. One which operates in model space and damps efforts by the algorithm to make the model rough. The second operates in data space and down-weights data with large residuals at each iteration. This means that data that is easy to fit will be fit first. 4 refs., 13 figs.

49734 (EUR–12229) **CEC project Mirage - Second phase on migration of radionuclides in the geosphere: Second summary progress report (Work period 1988).** Come, B. (ed.) (Commission of the European Communities, Brussels (BE)). Commission of the European Communities, Luxembourg (Luxembourg). 1989. 22p. Source: NTIS (US Sales Only), PC A03/MF A01.

A second phase of the Community coordinated project Mirage (migration of radionuclides in the geosphere) was launched in 1986. The present report brings together reviews of work done in the four research areas of this phase for 1988, and therefore constitues an update of the previous report, ref. EUR 11589. This project is part of the CEC R and D programme on radioactive waste management (1985-89).

49735 (GSC–90-1F) **Current research, part F. Frontier Geoscience Program. Cordilleran and offshore basins, British Columbia.** Geological Survey of Canada, Ottawa, ON (Canada). 1990. 164p. (MICROLOG–90-03552). Source: PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A compilation of 26 reports from a Canadian geological research program investigating frontier areas in British Columbia is presented. The subjects of the reports include stratigraphy, geologic structures, geologic formations, sedimentology, paleontology, petroleum source rock potential, palynology, and geochronology. The geographic regions studied are mostly in the Queen Charlotte Islands. Separate abstracts have been prepared for 4 of the reports in this compilation.

49736 (GSC–Bull-390) **Uppermost Devonian and lower Carboniferous stratigraphy, sedimentation, and diagenesis, southwestern District of Mackenzie and southeastern Yukon Territory (NTS 95 B, C, F, and G).** Richards, B.C. (Inst. of Sedimentary and Petroleum Geology, Calgary, AB (Canada)). Geological Survey of Canada, Ottawa, ON (Canada). 1989. 143p. (MICROLOG–90-02989). Source: PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $18.00 CAN; MF $10 CAN.

The geologic formations in the study region consist of a succession of continental terrace wedge deposits comprising a shale lithosome that intertongues eastward with 3 successions of slope/shelf, platform/ramp, and delta facies. Basinal and prodelta shale in the Besa River Formation constitutes the eastern part of the shale lithosome, and the lower Banff, Clausen, and Golata formations are its eastern tongues. The lower Banff is mainly basinal shale, but the slope/shelf upper Banff is mainly shelf limestone and sandstone. Graded beds dominate the slope/shelf facies of the western, lower Yohin, which overlies mainly the Besa River; the upper Yohin in the east is chiefly shallow shelf sandstone. Each of the 4 carbonate buildups present successively prograded farther westward. Platform shelf limestone constitutes most of the Pekisko, which abruptly overlies the upper Banff. The Prophet ramp and platform facies, overlying Besa River and Clausen shale, comprise slope spiculite and limestone that both underlie and pass eastward into more proximal ramp and platform deposits of Formation F and the Flett. The Golata, mostly prodelta shale, conformably overlies the Prophet and Flett. Siliclastics in this succession had a northern provenance. The calcite cement was precipitated in the meteoric-phreatic and subsurface zones; spicules provided silica for chert. The detailed information in this report will contribute to the accurate assessment of petroleum resources in this frontier region. Anomalies in the stratigraphic nomenclature have been corrected, placing the lithostratigraphy on a firm basis. Detailed paleontological control essential to local and interregional correlation is also presented. 248 refs., 89 figs., 1 tab.

49737 (IS-IPRT–5) **Iowa State Mining and Mineral Resources Research Institute final report, July 1, 1988–June 30, 1989.** Iowa State Univ. of Science and Technology, Ames, IA (USA). Iowa State Mining and Mineral Resources Research Inst. Sep 1989. 175p. Sponsored by U.S. Department of the Interior. DOE Contract W-7405-ENG-82. Grant G1184119. Order Number DE90017513. Source: NTIS, PC A09/MF A01 - OSTI; GPO Dep.

This Final Report describes the activities of the Iowa State Mining and Mineral Resources Research Institute (ISMMRRI), at Iowa State University for the period July 1, 1988 to June 30, 1989. The Institute has supported research efforts during this period to: investigate methods of leaching zinc from sphalerite-containing ores; determine the rate at which a nuclear waste form will dissolve as ground water flows past; predict rock trenchability in terms of trenching rates for available rotary trenchers, and make improvements in the design and operation of mechanical excavators; investigate the effects of variations in moisture content and fine particle concentration on the flow characteristics of coal; study the geochemistry and geology of an Archean gold deposit; investigate the impurities in mined rock salt and their effect on concrete pavements; enhance low-quality aggregates for use in construction; investigate an igneous intrusion with possible copper, nickel, and platinum mineralization; investigate the geology of the Atlantic Pass, Wyoming, gold district; evaluate the use of available software in developing concurrent sand and gravel mine operations and reclamation planning; focus on mechanisms of coal-water mixture combustion in fluidized beds; develop an on-line instrument to detect carbon in the exhaust gas of coal-fired boilers; study the chemistry and origin of manganiferous cherts and their relationship to gold and base metal sulfide deposits; develop a coal handleability index that will predict the ease with which coal will move by gravity flow through their systems; categorize the carbonate rocks in Iowa for use in desulfurization of coal during fluidized bed combustion; and development of crystal/grain alignment during processing of yttrium-barium-copper-perovskite superconductors. 131 refs., 41 figs., 18 tabs.

49738 (IS-IPRT–6) **Iowa State Mining and Mineral Resources Research Institute: Semi-annual report, July 1, 1989–December 31, 1989.** Iowa State Univ. of Science and Technology, Ames, IA (USA). Jan 1990. 37p. Sponsored by U.S. Department of the Interior. DOE Contract W-7405-ENG-82. Grant G1194119. Order Number DE90017514. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This semi-annual report describes the activities of the Iowa State Mining and Mineral Resources Research Institute (ISMMRRI) at Iowa State University, Ames, Iowa, funded by the US Department of Interior, Bureau of Mines, for the period of July 1, 1989 to December 31, 1989. Nine graduate research projects and one undergraduate project are described in the areas of extractive metallurgy, mineral processing, characterization and exploration, and fuel science. Although the graduate students are associated with several different academic departments and are pursuing master's and doctoral degrees in their respective disciplines, they are also all minoring in Mineral Resources. In addition, ISMMRRI hosted the Third International Conference on Processing and Utilization of High-Sulfur Coals, November 14–16, 1989, held in Ames, Iowa. 12 refs., 4 figs., 4 tabs.

49739 (LA–11849-MS) **Isotope geochemistry: A critical component of energy research.** Cole, D.R.; Curtis, D.B.; DePaolo, D.J.; Gerlach, T.M.; Laul, J.C.; Shaw, H.; Smith, B.M.;

Sturchio, N.C. Los Alamos National Lab., NM (USA). Sep 1990. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. Order Number DE90018027. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document represents the consensus of members of the ad hoc Committee on Isotope Geochemistry in the US Department of Energy; the committee is composed of researchers in isotope geochemistry from seven of the national laboratories. Information included in this document was presented at workshops at Lawrence Berkeley Laboratory (April 1989) and at Los Alamos National Laboratory (August 1989).

49740 (LA-UR-90-2571) **Numerical models of 2-D and 3-D geophysical convection.** Travis, B.J. Los Alamos National Lab., NM (USA). [1990]. 7p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-901109-10: International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers, Dallas, TX (USA), 25-30 Nov 1990). Order Number DE90014979. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A suite of computational models has been developed which simulate thermal/chemical convection over a wide range of Rayleigh numbers both in 2-D annular and 3-D Cartesian geometries, for small Reynolds number flow, and a variety of boundary conditions. These simulators are revealing the patterns of convection that may occur in the earth, from mantle scale down to more localized regions such as mid-ocean spreading centers, on down to the scale of magma chambers. Features such as surface plates, variable viscosity and chemical buoyancy can have a dramatic impact on convective patterns compared to those seen in simple, constant property, free or fixed surface systems. In most cases, the nonlinear dynamics of these systems derive from thermal and chemical forces, rather than inertial. These models can be used to study general features and dynamics of convecting viscous fluids, and can also be used to constrain possible explanations for geophysical observations such as heat flow, gravity, topography, plate speeds, and isotopic distributions. Computational resources have reached a level at which numerical solutions of complex processes are feasible.

49741 (PNL-5895) **Well network and measurement schedules for monitoring water-level changes beneath the separations area of the Hanford Site.** Last, G.V.; Young, M.A.; Liikala, T.L.; Jensen, E.J. Pacific Northwest Lab., Richland, WA (USA). Aug 1990. 284p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract AC06-76RL01830. Order Number DE90017516. Source: NTIS, PC A13/MF A01 - OSTI; GPO Dep.

In support of the Basalt Waste Isolation Project, Pacific Northwest Laboratory selected a network of wells and measurements schedules for monitoring water-level changes beneath the Separations Area, which encompasses the 200-East and 200-West Areas of the Hanford Site. The purpose of the water-level monitoring network was to allow collection of basic data that could be used to investigate how changes in wastewater discharges in the Separations Area might affect hydraulic heads in the deeper confined aquifers. Pacific Northwest Laboratory monitored water levels in 78 originally selected wells from May 29, 1984, through September 3, 1985. During this monitoring period, some originally selected wells found to unusable, and other wells (or piezometers) were added to the monitoring well network to replace the unusable wells or to increase the amount of data from selected areas. The final monitoring network consisted of 92 wells ad piezometers (completed at various intervals in the unconfined and uppermost confined aquifers) and 5 surface-water gaging stations. Completion uncertainties exist for a number of the wells. Recommendations for resolving these uncertainties include surveying, visual inspection via a downhole camera, geophysical logging, and, in some cases well renovation. 7 refs., 2 figs., 6 tabs.

49742 (SAND-90-1126C) **Recent field trials of directional boring equipment for emplacing a borehole grid around and beneath a simulated waste site.** Wemple, R.P.; Lysne, P.J.; Jacobson, R.D. Sandia National Labs., Albuquerque, NM (USA). [1990]. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9010166-1: 6. annual Department of Energy model conference on waste management and environmental restoration, Oak Ridge, TN (USA), 29 Oct - 2 nov 1990). Order Number DE90017596. Source: NTIS, PC A02/MF A01 - OSTI.

Chemical/mixed waste sites located in western states are often found in arid regions where the unconsolidated alluvium contains multiple layers of various fines, gravel and cobbles. The transport of contaminants from the near-surface layers to deeper underlying aquifers proceeds either through movement of gas-phase material or through capillary movement of formation fluids driven by periodic episodes of precipitation. Developing in situ methods to characterize the site geology, emplace monitoring equipment, and isolate a problem waste site from the surrounding uncontaminated formation is essential. Since January 1990, the authors have been developing strategies, evaluating commercial equipment, and planning adaptation/extension of existing directional boring technology to cost-effectively enclose a waste site in a grid of vertical and horizontal boreholes. Directional holes have been completed in field trials at SNL (Sandia National Laboratories) and at a manufacturer's sites to demonstrate concept. This paper is presented in outline form with a minimum of text. Reduced-scale information panels are used to communicate the bulk of the project information. 21 figs.

49743 (UCRL-JC-104272) **The dynamics of magma transport and eruption processes: An overview of recent developments.** Carrigan, C.R. (Lawrence Livermore National Lab., CA (USA)); Eichelberger, J.C.; Stockman, H.W. Lawrence Livermore National Lab., CA (USA). May 1990. 28p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-901109-15: International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers, Dallas, TX (USA), 25-30 Nov 1990). Order Number DE90015123. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The transport of magma in the Earth's crust and its eruption onto the surface can be strongly affected by seemingly subtle details of mass and heat transfer that are often overlooked. In particular, model calculations indicate that the multiphase nature of magma will exert a significant influence. The dynamics of flowing magma may be further enriched by chemical heterogeneity. A variety of studies indicate that a heterogeneous magma can be self-lubricating if viscous segregation of its components occurs. Subtle modifications of dike geometry and boundary conditions can also significantly affect magma transport in thermally unfavorable regimes. Nearer to the surface, changes with time in the permeability of vent boundaries that control leakage of the vapor phase have been linked to the normal progression from explosive, ash producing events to more effusive ones that form lava domes. In this review we attempt to integrate a variety of effects into a coherent view of magma transport and eruption. 16 refs., 8 figs.

49744 (WAU/CGS-CE03140) **Materials: From theory to practice: Proceedings.** Canadian Geotechnical Society, Waterloo, ON (Canada). 1989. 367p. (CONF-891015--: 42. Canadian geotechnical conference, Winnipeg (Canada), 23-25 Oct 1989; CE-03140). Source: Canadian Geotechnical Society, University of Waterloo, Waterloo, ON, CAN . Prices: PRICES UPON REQUEST.

A conference was held to communicate the results of Canadian research of various geotechnical topics. Papers were presented on field investigation techniques, soil and rock characterization, modelling, design of geotechnical structures such as dams, stability analysis, hydrology and environmental phenomena, construction of dams and embankments, containment barriers, and performance measurement of structures such as foundations, piles, bridges, and embankments. Separate abstracts have been prepared for 6 papers from this conference.

64 PHYSICS I

49745 (JINR-2-35-89) **JINR rapid communications: Collection.** Joint Inst. for Nuclear Research, Dubna (USSR); Joint Inst.

for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation. 1989. 56p. (In Russian). Order Number DE90706214. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

Individual items are processed separately. (DLC)

6401 Astrophysics and Cosmology

Refer also to citation(s) 49344, 49362, 50106

49746 (CBPF-NF–001/89) **On the thermodynamics of one-fluid Szekeres'like cosmologies.** Lima, J.A.S.; Tiomno, J. Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1989. 14p. Order Number DE91600982. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The thermodynamic behavior of the inhomogeneous Szekeres type cosmologies with a perfect fluids as source of gravitation is examined. Since the matter motion is geodetic, the absence of heat flow implies that the temperature is a function of time alone. For a subclass approaching homogeneity and isotropy at large cosmological times an expression for the temperature is derived. It does not coincide with the law of temperature satisfied by the FRW universes, even asymptotically. However, by assuming an equation of state explicitly dependent of the space coordinates, it is shown that the FRW thermodynamics may be recovered. In all cases the Euler and Gibbs-Duhem relations are no longer valid. (author).

49747 (CEA-CONF–10033) **Interstellar gas cycling powered by star formation.** Lioure, A.; Chieze, J.P. CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France). 1989. 6p. (CONF-8906359–: Colloquium on Physical Processes in Fragmentation and Star Formation, Rome (Italy), 5-11 Jun 1989). Order Number DE91700508. Source: NTIS (US Sales Only), PC A02/MF A01.

Star formation in molecular clouds is a low efficiency process. The mean conversion efficiency of gas into stars is about 1 - 10%, but lower values are often derived. Star formation is followed by a rapid dispersion of the unprocessed material from the active region. As a result, a large mass flux from the cold molecular phase of the interstellar medium towards its more diffuse phases is produced. When stationary state is assumed, this imprints a cycle of the interstellar matter, powered by star formation and feeded by the disruption of molecular clouds. We suggest that the flow is dominated by condensation processes which in sequence bring the gas to the highest densities found in protostellar clumps: cooling processes and related instabilities drive heated gas to HI state followed by mechanical processes as collisions of HI clouds or gravitation inside individual molecular clouds. Simplifying assumptions upon the condensation rates of each process allow for the calculation of the mass distribution over these various phases. The model presented here is a dynamical version of the standard two phase model, and predicts a nonequilibrium - though stationary - continuous distribution of luke-warm gas.

49748 (DOE/ET/53088–450) **Numerical study of compressible magnetoconvection with an open transitional boundary.** Hanami, H.; Tajima, T. Texas Univ., Austin, TX (USA). Inst. for Fusion Studies. Aug 1990. 43p. Sponsored by U.S. DOE Energy Research; Japan Society for the Promotion of Science; Nukazawa Memorial Foundation; National Science Foundation. DOE Contract FG05-80ET53088. (IFSR–450). Order Number DE91000148. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We study by computer simulation nonlinear evolution of magnetoconvection in a system with a dynamical open boundary between the convection region and corona of the sun. We study a model in which the fluid is subject to the vertical gravitation, magnetohydrodynamics (MHD), and high stratification, through an MHD code with the MacCormack-Donner cell hybrid scheme in order to well represent convective phenomena. Initially the vertical fluid flux penetrates from the convectively unstable zone at the bottom into the upper diffuse atmosphere. As the instability develops, the magnetic fields are twisted by the convection motion and the folding magnetic fields is observed. When the magnetic pressure is comparable to the thermal pressure in the upper layer of convective zone, strong flux expulsion from the convective cell interior toward the cell boundary appears. Under appropriate conditions our simulation exhibits no shock formation incurred by the fluid convected to the photosphere, in contrast to earlier works with box boundaries. The magnetic field patterns observed are those of concentrated magnetic flux tubes, accumulation of dynamo flux near the bottom boundary, pinched flux near the downdraft region, and the surface movement of magnetic flux toward the downdraft region. Many of these computationally observed features are reminiscent of solar observations of the fluid and magnetic structures of their motions.

49749 (DOE/ET/53088–452) **On the origin of cosmological magnetic fields.** Tajima, T. (Texas Univ., Austin, TX (USA)); Cable, S.; Shibata, K.; Kulsrud, R.M. Texas Univ., Austin, TX (USA). Aug 1990. 41p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract FG05-80ET53088. (IFSR–452). Order Number DE90017617. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

It is shown that a plasma with temperature T sustains fluctuations of electromagnetic fields and particle density even if it is assumed to be in a thermal equilibrium. The level of fluctuations in the plasma for a given wavelength and frequency of electromagnetic fields is rigorously computed by the fluctuation-dissipation theorem. A large zero frequency peak of electromagnetic fluctuations is discovered. We show that the energy contained in this peak is complementary to the energy "lost" by the plasma cutoff effect. The level of the zero frequency magnetic fields is computed as $(B^2)^0/8\pi = 1/2\pi^3\ T(\omega_p/c)^3$, where T and ω_p are the temperature and plasma frequency. This is the theoretical minimum magnetic field strength, as no turbulence is assumed. The size of the fluctuations is $\lambda \sim (c/\omega_p)(\eta/\omega)^{1/2}$, where η and ω are the collision frequency and the frequency of magnetic fields oscillations. These results are not in contradiction with the conventional black-body radiation spectra but its extension, and as such, do not contradict the observed lack of structure in the cosmic microwave background. The level of these is computed $B_{lambda} = 9.4 \times 10^{-7}\ (a/a_0)^{-1/2}\ (\lambda/1\ cm)^{-3/2}$ Gauss, where a and a_0 are the scale factors at time t and at present and λ the wavelength of magnetic fluctuations. Our computer particle simulation shows the support of the theory and in fact exhibits a peaking of the magnetic energy spectrum at zero frequency. The level of magnetic fields is significant at the early radiation epoch of the Universe. Implications of these magnetic fields in the early Universe are discussed.

49750 (ESA-SP–290) **Infrared spectroscopy in astronomy: Proceedings of the 22 Eslab Symposium.** Glasse, A.C.H.; Kessler, M.F.; Gonzalez Riestra, R. European Space Agency, 75 - Paris (France). Sep 1989. 613p. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

In this meeting the following subjects were reviewed: solar system, interstellar medium, star formation, galactic structure, extragalactic astronomy, studied by infrared spectroscopy.

49751 (ESA-SP–290, pp. 3-14) **IR spectroscopy of planets and satellites; Venus, Mars, giant planets and titan.** Encrenaz, T. (Observatoire de Paris, 75 (FR)). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Infrared spectroscopy is an essential tool for studying planetary atmospheres and surfaces, both in the reflected sunlight component and in the thermal emission spectrum.

49752 (ESA-SP–290, pp. 15-36) **Infrared cometary spectroscopy.** Crovisier, J. (Observatoire de Paris, Section de Meudon, 92 (FR)). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Infrared spectroscopy, with microwave and submillimetre spectroscopy, is practically the only remote-sensing technique able to

study stable molecules sublimed from the nucleus or formed by gas-phase chemistry in the inner coma. We review here recent observations and theoretical works concerning cometary molecules, relevant to infrared spectroscopy.

49753 (ESA-SP–290, pp. 37-40) **Analogies between cometary, interplanetary and interstellar matter.** Puget, J.L. (Ecole Normale Superieure, 75 - Paris (FR)). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

The search for analogies between interstellar matter and dust in the solar system (both interplanetary and cometary) is shown to the be fruitful not only because some interstellar particles survived the formation of the solar system and are locked in interplanetary dust but because the physical processes to which cometary and interplanetary dust are subjected are very similar to those at work in interstellar clouds.

49754 (ESA-SP–290, pp. 49-54) **The unidentified IR bands in laboratory, in interstellar medium and in comets.** Colangeli, L. (European Space Research and Technology Centre, Noordwijk (NL)); Schwehm, G.; Bussoletti, E.; Fonti, S.; Blanco, A.; Orofino, V. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

A comparative analysis of IR spectral properties measured in laboratory for various carbonaceous materials shows that hydrogenated amorphous carbon grains, polycyclic aromatic hydrocarbon mixtures and coal tar present features which match in wavelength position some of the unidentified infrared (UIR) bands. The experimental results are applied to fit both astronomical and cometary observations. Some suggestions are derived about physico-chemical properties of the UIR band carriers in space and the relationship between interstellar and cometary materials.

49755 (ESA-SP–290, pp. 55-60) **Observations of CO on Mars in the infrared and millimetre range.** Encrenaz, Th. (Observatoire de Paris, 75 (FR)); Billebaud, F.; Lellouch, E.; Combes, F.; Gerin, M.; Maillard, J.P.; Paubert, G. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Millimeter observation of Mars in the (10) lines of CO and ^{13}CO has shown evidence for a significant enhancement of the ^{13}CO line with respect to the CO line. Following this result, high resolution observations of the CO (1-0) vibrational band at 4.7μm have been performed in 1988. Several martian lines of $^{12}C^{16}O$, ^{13}CO, $C^{17}O$ and $C^{18}O$ have been identified and analyzed. From the CO lines, a ratio $CO/CO_2 = 0.0015$ is derived. The other isotopic ratios of carbon and oxygen; this result apparently confirms the effect observed in the millimeter range. New observations of CO and ^{13}CO have been recorded in the (1-0) and (2-1) lines at several positions of the martian disk.

49756 (ESA-SP–290, pp. 61-66) **Near infrared spectroscopy of Mars: study of the surface mineralogy.** Encrenaz, T. (Observatoire de Paris, 75 (FR)); Bouchet, P. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Spectra of Mars have been recorded in September and October 1988, at the 1m telescope of ESO (La Silla, Chile), between 2.8 and 5.2 μ m, with a circular variable filter and a resolving power of 60. Spectra were recorded at the center of the disk, the north region and the south pole with an aperture of 5 arcsec. In all the spectra, there is a strong absorption around 3 μ m due to the OH bond in hydrated silicates, already observed previously. Weak absorption features seem to be superimposed at 3.4 and 3.8 μ m in some spectra and are probably representative of the surface mineralogy. Other absorption features are visible, especially in the cold regions, between 4.8 and 5.2 μ m: apart from the strong 4.25 μ m band, gaseous carbon dioxide is observed at 4.85 and 5.15 μ m; moreover, an absorption feature appears around 5.0 μ m in some spectra of the northern region. If this feature is confirmed, it might be interpreted as carbon monoxide chemically bound on the martian surface (possibly in form of metallic carbonyls such as Fe(CO)n).

49757 (ESA-SP–290, pp. 67-72) **A unified model for the 3.28 μ m and 3.4 μ m spectral feature in the interstellar medium and in comets.** Hoyle, F. (University Coll., Cardiff (UK). Dept. of Applied Mathematics and Astronomy); Wickramasinghe, N.C. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

The 3.4 μ m absorption feature seen in the spectra of GC-IRS7 and also in other sources in the galactic centre area is shown to be of interstellar rather than circumstellar origin. The implication is that a large fraction of interstellar grains are organic in character. The 3.28 μ m feature seen in emission in planetary nebulae, in external galaxies, and in the diffuse infrared radiation from the Galaxy is most likely due to aromatic hydrocarbons which are released as degradation products of organic grains. The same aromatic molecules can also explain the 2200A interstellar extinction feature. The detailed 2.8-3.6 μ m profiles of IRS7 obtained from both AAT spectra and Japanese sources can be explained on the basis of grains comprised of material closely resembling biogenic matter in their disposition of CH linkages. Dust particles possessing the same detailed spectral characteristics as the interstellar grains are able to match infrared spectra obtained for Halley's Comet.

49758 (ESA-SP–290, pp. 73-78) **Interpretation of the 10 μ m and 20 μ m absorption bands in comets, the ism and in an external galaxy.** Wickramasinghe, N.C. (University Coll., Cardiff (UK). Dept. of Applied Mathematics and Astronomy); Hoyle, F.; Majeed, Q.; Al-Mufti, S.; Wallis, M.K. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

The data for the Trapezium nebula in the wavelength range 8-30 μ m are compared with fluxes computed for models involving Murchison meteorite material, crystalline silicates, organic material and biomaterial. Generally similar mixtures of these components are shown to be indicated from astronomical data as widely ranging as comet Halley and the extragalactic source M82.

49759 (ESA-SP–290, pp. 79-92) **Infrared spectroscopy of dust.** Roche, P.F. (Royal Observatory, Edinburgh (UK)). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Infrared spectroscopy has allowed the identification of a number of different components of interstellar dust. Refractory species such as silicates and silicon carbide are commonly seen in circumstellar dust, whilst the former also dominate the infrared absorption by interstellar dust. In addition, spectral features from a number of more volatile species condensed on grains have been measured in cold, sheltered regions such as molecular clouds and dense circumstellar outflows from cool evolved stars. In diffuse regions, and particularly in ionization fronts and photodissociation regions close to hot stars, the infrared emission spectrum is dominated by a family of narrow emission features between 3 and 13 μ m produced by small carbon-rich grains. Recent observations have shown that there are a number of weak bands in addition to the well-known strong features.

49760 (ESA-SP–290, pp. 93-98) **Interstellar extinction in the infrared.** Draine, B.T. (Princeton Univ., NJ (US). Observatory). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Extinction by insterstellar dust at infrared wavelengths is reviewed. For $0.7 < \lambda < 7$ μ m the observed extinction, both in the Galaxy and in the Magellanic Clouds, appears to be consistent with a simple power law, A_λ proportional to $\lambda^{-1.75}$, although the observational uncertainties remain appreciable. In the 8-30 μ m region interstellar extinction is dominated by the 9.7 μ m and 18 μ m silicate features; the absolute strength (relative to the continuum extinction at shorter wavelengths), the detailed wavelength-dependence of these features, and the possible variation of the profile shape from diffuse clouds to dense clouds, all remain somewhat controversial. In the farinfrared $\lambda > \approx 30$ μ m grain emissivity estimates by different authors vary considerably; future observations of thermal emission from diffuse clouds in the 300 μ m region offer the prospect of substantially reducing uncertainties in far-infrared emissivities.

49761 (ESA-SP–290, pp. 99-108) **Spectropolarimetry as a diagnostic of the interstellar medium.** Aitken, D.K. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

An introductory treatment is given of the application of infrared spectropolarimetry to the study of the properties of dust grains and their environment. The analysis of the extinction and polarization expected from an arbitrary grain model is outlined, together with sufficient source citation to ennable application in a practical situation. Examples of some of the more recent observational work are presented in terms of their implications for dust grain physics and chemistry and the ambient magnetic field.

49762 (ESA-SP–290, pp. 109-114) **Chemistry on interstellar grains and implications for infrared spectroscopy.** Millar, T.J. (Manchester Univ. (UK). Dept. of Mathematics). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

In this article I review the infrared and millimetre-wave observations which suggest that the gas-grain interaction is important in dense clouds. This interaction results in the formation of H_2O ice in clouds having relatively low extinction. I argue that observations of the gas in hot molecular cores enables one to study grain surface processes since it appears very likely that this hot gas is rich in material evaporated from grains. The detection of large saturated molecules, such as dimethyl ether and ethanol, in such regions indicates that the surface chemistry may be very complex. Finally I discuss briefly how the unidentified infrared emission bands may be affected by chemical processes.

49763 (ESA-SP–290, pp. 115-132) **Photodissociation regions: observations and theory.** Genzel, R. (Max-Planck Institut fuer extraterrestrische Physik, Garching, (DE)); Harris, A.I.; Stutzki, J. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Photodissociation regions are copious emitters of infrared, millimeter and submillimeter line radiation. Detailed multiwavelength studies of such regions are now possible and reveal valuable information on the physical parameters of interstellar gas clouds and on the character of the UV radiation exciting them.

49764 (ESA-SP–290, pp. 161-168) **Infrared diagnostics for interstellar solid state chemistry.** Grim, R. (Rijksuniversiteit Leiden (NL)). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Recent laboratory research has opened the way to interpret interstellar absorption spectra from a different point of view. An overview of the interstellar IR absorption features is given with appropiate references for further reading. Recent laboratory results are noted point by point. Future ISO data reduction may benefit greatly from such studies.

49765 (ESA-SP–290, pp. 177-188) **Polycyclic aromatic hydrocarbons in the infrared spectra of IRAS sources.** Jourdain de Muizon, M. (Rijksuniversiteit Leiden (NL)). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

We present infrared spectra of IRAS sources, mainly HII regions and reflection nebulae. The observations include the IRAS Low Resolution Spectra (LRS) and ground-based 3μm spectra. All sources in our sample have strong emission features at 7.7, 8.6 and 11.3μm in their LRS spectra; in all of them, we have detected the strong 3.3μm emission band, often together with a feature at 3.4μm and an emission plateau at 3.4-3.6μm. The data are analysed in the context of the Polycyclic Aromatic Hydrocarbons (PAH) hypothesis. In particular, the size of molecules and their degree of hydrogenation are investigated. For a few sources, 3μm spectra at higher resolution reveal the presence of additional emission features in the 3.4-3.6μm region. Possible interpretations for these bands are discussed. Finally, new laboratory spectra are presented which show a general fit to the observed spectra. Observational test are suggested.

49766 (ESA-SP–290, pp. 189-192) **An almost total disjunction between emission and absorption dust features - what does it tell us.** Leger, A. (Paris-7 Univ., 75 (FR)); d'Hendecourt, L.B.; Verstraete, L.; Ehrenfreund, P. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

An important observational fact about dust features is the comparison between the absorption features and those seen in emission. The striking fact is the almost complete absence of overlap between these two sets of features. An interesting case is the comparison between the 3.4μm band attributed to aliphatic C-H bonds seen in absorption and the 3.3μm one assigned to aromatic C-H bonds seen only in emission. An interpretation is proposed.

49767 (ESA-SP–290, pp. 197-202) **Wide-beam balloon observations of the 157.7μm [CII]-line.** Nordh, H.L. (Stockholm Observatory, (SE)); Olofsson, S.G.; Bohlin, M.; Frisk, U.O.; Fridlund, C.V.M. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

The scientific rationale behind the use of a small-sized (30 cm) balloon telescope for wide-beam (11 arc minutes) spectroscopic observations in the far infrared particularly of the [CII] line at 157.7μm, is discussed. The technical details of the experiment are briefly summarized. Measurements of W3 performed during a flight in 1987 are reported and are shown to agree well with published results obtained using the Lear Jet. The prospects of future observations are discussed from both the scientific and technical points of view.

49768 (ESA-SP–290, pp. 293-298) **The environment of young stellar objects studied by high-resolution infrared spectroscopy.** Maillard, J.P. (Centre National de la Recherche Scientifique, 75 - Paris (FR). Inst. d'Astrophysique); Mitchell, G.F.

European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

We have observed several luminous embedded young stellar objects at high resolution (8 km s^{-1}) in the 4.7 μm region using the FTS of the CFH Telescope. The spectra cover most of the M band, showing the lines of the v=1-0 band of ^{12}CO and often of ^{13}CO with blueshifted components. We report observations of GL 2591, M8-IR, GL 490, W3 IRS5, sources of strong molecular bipolar outflows, and W33A. This technique has proved a very powerful probe of hot gas flows not detected at millimeter wavelengths, and then located near the central object. In most of the sources the lines are resolved in several distinct velocity components. In W33A, in which the 2140 cm^{-1} feature of solid CO is detectable, the ratio of solid to gas phase is measured.

49769 (ESA-SP–290, pp. 299-304) **Molecular hydrogen in the HII region G333.6-0.2.** Moneti, A. (European Southern Observatory, Garching (DE)); Moorwood, A.F.M. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

We have obtained IR spectral observations and a direct IR image of the galactic HII region G 333.6-0.2 in order to study the relative distribution of the shocked and the ionized gas components.

49770 (ESA-SP–290, pp. 203-206) **Near infrared spectroscopy of the supernova remnant RCW103.** Oliva, E. (Osservatorio Astrofisico di Arcetri, Florence (IT)); Moorwood, A.F.M.; Danziger, I.J. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Following our previous systematic study of the [Fe II], H_2 and hydrogen lines emission in supernova remnants we present detailed spectroscopic observations of RCW103, the most powerful source of IR lines emission among the galactic remnants studied so far.

49771 (ESA-SP–290, pp. 207-212) **A coal model for the carriers of the unidentified IR bands.** Papoular, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Inst. de Recherche Fondamentale (IRF)). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

The absorbance spectrum of vitrinite is shown to come closer to the generic spectrum of the unidentified IR bands (UIB's) than any previously proposed model. Vitrinite is the organic and major component of coal, its composition, structure and behaviour as a function of age, origin, heat, treatment, etc. are now fairly well known. A very large amount of IR data on vitrinite (as well as on the other components of coal) is also available and still accumulating. It appears from all these data that all coals have a limited number of mid-IR features; the factors mentioned above only alter the relative intensities of these features, leaving their positions and widths practically unchanged and identical to those of the UIB's. Each of the UIB's has its counterpart in the vitrinite spectra, which also exhibit a continuum rising toward the blue. The better fit provided by vitrinite over other models is due to the presence of oxygen, as well as hydrogen, in the form of surface functional groups bonded to a bulk, disordered, carbon structure with aliphatic as well as aromatic bonds.

49772 (ESA-SP–290, pp. 213-220) **Spectroscopy and physico-chemistry of CO:H_2O and CO_2:H_2O ices.** Schmitt, B. (Centre National de la Recherche Scientifique, 38 - Grenoble (FR). Lab. de Glaciologie); Grim, R.; Greenberg, M. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Recent laboratory measurements on both the spectral and physical properties of CO:H_2O and CO_2:H_2O ice mixtures have been performed. The effects of the composition, the temperature and the thermal history on the H_2O (3.1 and 6.0 μm), CO (4.67 μm) and CO_2 (4.27 μm) infrared bands are discussed. It is shown that additional informations on the composition and on the history of grain mantles can be obtained from a detailled analysis of these absorption bands.

49773 (ESA-SP–290, pp. 221-224) **Mapping and spectroscopy of the 3.3 μm feature in Orion.** Sellgren, K. (Hawaii Univ., Honolulu, HI (US). Inst. for Astronomy); Tokunaga, A.T.; Nakada, Y. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

We present the results of spectroscopy of the 3.3 μm feature, H_2 emission, and Brα, obtained in a spatial cut across the Orion ionization front. The spatial distribution of the 3.3 μm feature peaks between the ionization front and the H_2 peak. The shape of the 3.3 μm feature observed at high spectral resolution shows no changes in regions of varying UV flux and density. Our results are discussed in terms of current models for the 3.3 μm emission feature.

49774 (ESA-SP–290, pp. 225-232) **An implication of the IR identification of PAHs: the heating of the diffuse is gas.** Verstraete, L. (Paris-7 Univ., 75 (FR)); Leger, A.; d'Hendecourt, L.B.; Defourneau, D.; Dutuit, O. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

The HI diffuse medium as seen by 21-cm emission absorption observations shows essentially 2 phases in pressure equilibrium: the cold medium with T $\approx$ 40 to 400 K and n_H = 50 cm^{-3} and the warm medium with T = 6000 to 8000 K n_H = 5 10^{-1} cm^{-3}. The cooling mechanisms for the HI medium are now well understood but the heating required remains unaccounted for. We have estimated the heating due to photoionization of PAHs: it is found that PAHs dominate the heating of the cold phase and that it would represent an important fraction of that required for the warm phase.

49775 (ESA-SP–290, pp. 269-280) **The excitation of molecular hydrogen and its significance.** Sternberg, A. (Max-Planck-Institut fuer Physik und Astrophysik, Garching (DE). Inst. fuer Extraterrestrische Physik). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

The excitation of molecular hydrogen gas in interstellar environments is reviewed. Emphasis is given to the H_2 emission produced in photodissociation regions. Diagnostics of shock vs. photodissociation region H_2 emission are listed.

49776 (ESA-SP–290, pp. 305-306) **Infrared spectroscopy of late-type stars.** Jong, T. de (Amsterdam Univ. (NL)). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Published in summary form only. GIANT STARS/infrared radiation; EMISSION SPECTRA

49777 (ESA-SP–290, pp. 307-316) **Planetary nebulae.** Barlow, M.J. (University Coll., London (UK). Dept. of Physics and

Astronomy). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

A large number of infrared fine structure lines have now been observed from planetary nebulae and they provide a powerful tool for the determination of nebular physical parameters and abundances, for both ionised and neutral regions. Recent work on the modelling of the dust emission continua and on the derivation of gas-to-dust mass ratios is also reviewed.

49778 (ESA-SP–290, pp. 317-328) **Infrared spectroscopy of novae and related objects.** Bode, M. (Preston Polytechnic (UK). Div. of Physics and Astronomy). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Infrared spectroscopy of classical, dwarf and recurrent novae, together with symbiotic stars, is reviewed. Particular attention is paid to classical novae where infrared spectroscopy is invaluable in probing the early chemistry, formation of dust shells, and the origin of coronal line emission seen in many of these objects.

49779 (ESA-SP–290, pp. 329-338) **Infrared spectroscopy of supernova 1987A.** Meikle, W.P.S. (Imperial Coll. of Science and Technology, London (UK). Blackett Lab.). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

The infrared spectroscopic study of SN 1987A is providing a uniquely detailed view of the interior of a supernova explosion. At early times the IR spectrum of SN 1987A was dominated by continuum emission, with P-Cygni profiles, mostly hydrogen, superimposed. By day 200, the IR spectrum was dominated by emission lines. As the supernova aged, forbidden lines became increasingly prominent. About 20 species, including molecules, have been identified. Approximate estimates of the mass of iron and cobalt in the ejecta have been obtained. There is general agreement that the substantial masses found are consistent with their originating from the decay of 0.078 solar mass of ^{56} Ni created in the explosion. Comparison of IR spectral models with the data should allow constraints to be placed upon possible explosion scenarios.

49780 (ESA-SP–290, pp. 339-342) **High resolution infrared spectroscopy of symbiotic stars.** Bensammar, S. (Observatoire de Paris, Section de Meudon, 92 (FR)). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

We report here very early results of high resolution ($5x10^3$ - $4x10^4$) infrared spectroscopy (1 - 2.5 μm) of different symbiotic stars (T CrB, RW Hya, CI Cyg, PU Vul) observed with the Fourier Transform Spectrometer of the 3.60m Canada France Hawaii Telescope. These stars are usually considered as interacting binaries and only little details are known about the nature of their cool component. CO absorption lines are detected for the four stars. Very different profiles of hydrogen Brackett γ and helium 10830 A lines are shown for CI Cyg observed at different phases, while Pu Vul shows very intense emission lines.

49781 (ESA-SP–290, pp. 343-350) **Herbig Ae/Be stars: fine structure far-infrared lines.** Ceccarelli, C. (Consiglio Nazionale delle Ricerche, Frascati (IT). Ist. di Fisica dello Spazio Interplanetario); Lorenzetti, D.; Saraceno, P.; Spinoglio, L.; Ingrosso, G.; Strafella, F. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

We present here the preliminary results on the most important far-infrared fine-structure lines in the partially ionized regions around Herbig Ae/Be stars. Although a very simple chemistry is assumed, our model, balancing the main contributions to heating and cooling on a grid of spherical zones, allows an estimate of the line fluxes. The results are compared with the sensitivity of the Long Wavelength Spectrometer (LWS) on board of the future ESA satellite ISO.

49782 (ESA-SP–290, pp. 351-354) **Ice grains in the dust disk of the bipolar nebula M 1-92.** Eiroa, C. (Observatorio Astronomico Nacional, Madrid (ES)); Hodapp, K.W. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

We present 2.4 - 3.8 um spectra of the bipolar nebula M 1-92, taking with the cooled grating array spectrometer at the NASA Infrared Telescope Facility (Mauna Kea). Data were obtained at five positions of the object: one coinciding with the illuminating star, and the rest distributed along the dust torus the bipolar nebula. No spectral signature is observed at the position of the star. On the other hand, a narrow 3.1 um absorption is observed in all four positions of the torus. The feature is interpreted as being due to a mixture of pure amorphous and crystalline water ices. We suggest that M 1-92, OH 231.8 + 4.2 and IRAS 09371 + 1212 form a distinct group among the evolved bipolar nebulae, characterized by the presence of pure water ices in their associated dust tori.

49783 (ESA-SP–290, pp. 355-358) **CO infrared bands in atmospheres of long-period variables.** Heske, A. (Rijksuniversiteit Leiden (NL)). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

This paper presents an ongoing study of the CO infrared bands in atmospheres of long-period-variables. The intensities of the different bands do not follow the Boltzmann-distribution for a single temperature, in particular no fundamental band has been detected. The width of the 2nd overtone was found to significantly broader than that for the 1st overtone. It will be concluded that the different bands are characteristic features for different temperature layers in the atmospheres and circumstellar envelopes of variables.

49784 (ESA-SP–290, pp. 359-362) **A survey of PAH emission in HII regions, planetary and proto-planetary nebulae.** Jourdain de Muizon, M. (Rijksuniversiteit Leiden (NL)); Cox, P.; Lequeux, J. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

We report on preliminary results of a systematic investigation of PAH emission in H II regions, planetary nebulae (PN) and proto-planetary nebulae (PPN). This emission occurs in a vast majority of H II regions showing the ubiquity of the carriers. With the possible exception of NGC 6302, PAH emission is only seen in carbon-rich PNs and PPNs and is quite common in this case. This shows that PAHs are formed, at least partly, in carbon-rich evolved objects. This paper is an updated version of a paper presented at the IAU Symposium No. 135 (Interstellar Dust) in July 1988.

49785 (ESA-SP–290, pp. 367-370) **IR spectrophotometry of bright carbon stars.** Lazaro, C. (Instituto de Astrofisica de Canarias, Tenerife (ES)). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Medium resolution spectrophotometry of 15 bright Carbon stars of class N has been obtained in the range λ: 1-4.2 μm, complemented by wide band photometry in JHKLM for a bigger sample. The selected sample of stars does not show evidence of massive circumstellar dust envelopes and the infrared flux is expected to arise mainly from a, hopefully, only little disturbed photosphere. The observed flux distributions have been compared with those predicted by model atmospheres, both with and without polyatomic molecules, in order to derive the effective temperatures of the stars. Important differences arise between the observed spectra and the predictions of models, constraining their validity and giving some insight into the possible origins of the disagreement.

49786 (ESA-SP–290, pp. 371-374) **Dust in planetary nebulae: IRSPEC observations in the 3.0 μm - 3.8 μm range.** Magazzu, A. (Osservatorio Astrofisico, Catania (IT)); Strazzulla, G. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

We present IRSPEC observations ($\lambda/\Delta\lambda \approx 1100$) of planetary nebulae in the 3.0-3.8 μm range. The detection of some of the so-called unidentified infrared features is discussed in the light of the current theories concerning dust grain properties.

49787 (ESA-SP–290, pp. 375-378) **Near infrared (1 - 4 μm) spectroscopy of SN1987 A.** Oliva, E. (Osservatorio Astrofisico di Arcetri, Florence (IT)); Moorwood, A.F.M.; Danziger, I.J. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

We present spectral observations of SN1987 A between 1.05 μm and 4.2 μm at resolving power $R \approx 1500$ collected at the ESO 3.6m telescope using the ESO grating array spectrometer IRSPEC during October 87, April 88 and October 88.

49788 (ESA-SP–290, pp. 379-380) **Observations of 40-70 μm bands of ice in IRAS 09371+1212 and other stars.** Omont, A. (Grenoble-1 Univ., 38 (FR)); Forveille, T.; Moseley, S.H.; Glaccum, W.; Harvey, P.M.; Likkel, L. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

IRAS09371+1212 is up to now an absolutely unique object. This M giant star, with circumstellar CO, has unique IRAS colors, attributed to strong emission in the 40-70 μm bands of ice. This suggestion has been strengthened by subsequent observations of a strong 3.1 μm absorption band. Our recent KAO observations now confirm its unusual nature: the far infrared bands of ice are by far the strongest known in the sky. Its dust temperature, < 50K, is by far the lowest known for a circumstellar envelope. Ice is clearly crystalline, and there are indications that the emissivity index of the silicates is ≈ 2. The 43 μm band is also detected in several very cold OH/IR circumstellar envelopes.

49789 (ESA-SP–290, pp. 381-384) **Carbon monoxide in supernova 1987A.** Spyromilio, J. (Imperial Coll. of Science and Technology, London (UK). Blackett Lab.); Meikle, W.P.S.; Learner, R.C.M.; Allen, D.A. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

The identification of carbon monoxide (CO) in the infrared spectra of SN 1987A and of CO^+ represents the first ever detection of a molecule in a supernova. In IR spectra obtained with the Anglo-Australian Telescope (AAT), first overtone emission from CO was observed near 2.3 μm as early as day 112 after the explosion, and was clearly detectable in all subsequent spectra. Spectra of the CO fundamental at 4.6 μm support this identification. We argue that the CO forms part of the supernova ejecta, and present a preliminary analysis of the first overtone band using Boltzmann population statistics. The model reproduces well the spectra obtained on days 192 and 255 and implies the presence of about $5X10^{-5}$ solar mass of CO by day 255. By day 284 the fit is less good, due to increasingly prominent emission from other species, possibly in combination with the breakdown of the Boltzmann distribution.

49790 (ESA-SP–290, pp. 385-386) **Predictions of infrared recombination lines in stellar winds of hot stars.** Strous, L.H.; Lamers, H.J.G.L.M. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Infrared recombination lines can provide accurate estimates for the velocity and density structure of stellar winds and thus of mass loss. We use a simple stellar wind model, hydrogenic approximations and scaling laws to derive information about recombination lines in the ISO range (1-100μm). We estimate that, for a 40000K star, the boundary-level from above which recombination lines originate is in the range n=2-10 for the most abundant elements. We give a simple formula to estimate the population of levels above the boundary-level and use this to produce a table of predictions of fluxes and equivalent widths of recombination lines for H, He, C, N and O.

49791 (ESA-SP–290, pp. 387-392) **Detection of SN1986j in NGC891 at millimetre wavelengths.** Tuffs, R.J. (Max-Planck-Institut fuer Kernphysik, Heidelberg (DE)); Chini, R.; Kreysa, E. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Supernova 1986j in NGC 891 has been detected at λ 1.2 mm and λ 3 mm at epoch 1986.8 using the IRAM 30-m millimetre radio telescope (MRT). It is the first supernova to be detected at near-millimetre wavelengths. The spectrum between λ3 and λ1.2 mm is flat, or rising towards shorter wavelengths, lying well above the extrapolation of the optically thin synchrotron radio spectrum of SN1986j at centimetre wavelengths at a similar epoch. The MRT observations are interpreted as arising from a pulsar-powered synchrotron nebula at the centre of the expanding layers of supernova ejecta which is physically distinct from the circumstellar interaction region from which the centimetre wavelength radio emission is produced. The observations suggest that millimetre wavelength and far-infrared spectrophotometry will be a useful tool to investigate pulsars and the pulsar environment in recent supernovae.

49792 (ESA-SP–290, pp. 393-402) **JCMT observations of the circumstellar envelope IRC + 10216.** Williams, P.G. (Queen Mary Coll., London (UK). Dept. of Physics); White, G.J.; Sanderson, C.A. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Observations of the circumstellar envelope IRC + 10216 made with the James Clerk Maxwell Telescope are presented. Maps with the 14 min FWHM beam have been made in the CO J=3-2, CS J=7-6 and HCN J=4-3 transitions. The radial CO distribution agrees in shape with the Kwan/Linke outflow model, but is lower in intensity by an overall factor of 0.54. The HCN intensity is nearly double that of CO, but drops off almost twice as rapidly with distance from the source centre. Single spectra at the source centre are also presented for the isotopes ^{13}CO, $H^{13}CN$, $C^{34}S$ and for the lower excitation J=3-2 line of HCN and its isotope $H^{13}CN$ (with 23 min FWHM beam).

49793 (ESA-SP–290, pp. 419-420) **Velocity-resolved spectra of BRα and BRγ on IRS16 SW and NE.** Maillard, J.P. (Centre National de la Recherche Scientifique, 75 - Paris (FR). Inst. d'Astrophysique); Gay, J. European Space Agency, 75 - Paris

(France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Published in summary form only. MILKY WAY/galaxy nuclei; HYDROGEN; SPECTRA; BALMER LINES

49794 (ESA-SP–290, pp. 431-438) **Near infrared spectroscopy of active galaxies.** Moorwood, A.F.M. (European Southern Observatory, Garching (DE)). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Recent progress in applying near infrared spectroscopy to the study of active galactic nuclei is reviewed. This wavelength region contains important lines such as the Paschen and Brackett hydrogen recombination lines, HeI(1.083μm) and OI(1.1287μm) which complement lines in the visible spectrum for studies of the reddening and physical conditions. With current array spectrometers it is now possible to observe Hα at high s/n in QSOs at z$\approx$2 and to measure linewidths and profiles with sufficient resolution to investigate for e.g the question of visually obscured BLRs in Seyfert 2 galaxies. Strong [FeII] and H_2 line and 3.28 μm feature emission observed in galaxies with Seyfert nuclei imply vigorous star forming activity and/or an interaction between the active nucleus and circumnuclear gas.

49795 (ESA-SP–290, pp. 439-446) **Near-infrared spectroscopy of starburst and interacting galaxies.** Joseph, R.D. (Imperial Coll. of Science and Technology, London (UK). Blackett Lab.). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Near-infrared spectroscopy has developed as a new branch of extragalactic astronomy over the past 4-5 years. Features due to atomic and molecular hydrogen, FeII, CO, and the unidentified 3.28μm dust feature are generally strong and detectable in galaxies using modern instrumentation. An overview of the results of the largely exploratory observations undertaken to date is presented. The major focus is to illustrate the potential of near-infrared spectroscopy to illuminate the physics and astrophysics of starbursts in galaxies. Some of the uncertainties, as well as the more firm conclusions are highlighted. Finally, it is suggested that the initial exploratory phase of extragalactic near-infrared spectroscopy is over, and the subject is sufficiently developed to take its place as part of the armamentarium of modern extragalactic astronomy.

49796 (ESA-SP–290, pp. 447-454) **Spectroscopy of galaxies in the mid-infrared.** Roche, P.F. (Royal Observatory, Edinburgh (UK)). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

The mid-infrared spectral properties of galaxies are described. Most of the galaxies that are bright in the mid-infrared are dominated by emission from dust, although non-thermal emission may be important in the most luminous active nuclei. There are clear differences between the spectra of galaxies with powerful HII regions in their nuclei and those containing AGN. In particular, the family of unidentified emission bands between 3 and 13 μm dominates the spectra in the former objects, but are rarely evident in spectra of AGN. In many AGN, evidence of silicate dust is provided by the presence of the 9.7 μm silicate absorption band; the strong spectral structure in HII region galaxies renders measurement of the silicate band in those objects difficult. Overall, dust properties in galaxies and in the Milky Way are broadly similar, but there are significant differences in the mix of grain components between dust around AGN and other galaxy nuclei. Fine-structure ionic lines, particularly of [NeII], are frequently detected in HII region galaxy nuclei; they have not yet been detected in active nuclei. The relative strengths of the emission lines can yield useful constraints on the excitation of the ionized gas, and the effective temperature of the exciting stars.

49797 (ESA-SP–290, pp. 473-476) **Infrared spectroscopy of star formation in galaxies: extreme conditions and very short time scales.** Beck, S.C. (Tel Aviv Univ. (IL). Dept of Astronomy); Ho, P.T.P.; Turner, J.L. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

We have measured Brackett α and γ with a 7.2 min beam and 350 km/sec spectral resolution in 11 infrared-bright galaxies and used the fluxes as diagnostics of the population of young OB stars. The star-formation activity in the program galaxies is surprisingly concentrated in both space and time. The OB stars present in 7.2 min are sufficient to generate the bulk of the infrared emission observed in the much larger area measured by IRAS, and the OB stars in several galaxies are no older than a few million years. In some galaxies the ratios of Brackett to radio continuum flux are unusual and could indicate the presence of ultra compact H_{II} regions, very low electron temperatures, or widespread departures from Case B recombination. In all galaxies the 10 μm continuum flux exceeds that which can be produced by the Lyman heating of dust. Our conclusions are that conditions in star-formation sources can be quite extreme, and that Brackett lines are flexible and powerful probes of conditions in external galaxies.

49798 (ESA-SP–290, pp. 477-480) **The strengths of the 2.3 μm CO band in luminous interacting and merging galaxies.** Doyon, R. (Imperial Coll. of Science and Technology, London (UK). Blackett Lab.); Joseph, R.D.; Wright, G.S. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Spectra between 2.0 and 2.5 μm are presented for NGC 1614, NGC 2798, NGC 4565, NGC 6240, NGC 253 and ARP 220. We show that the strength of the CO band at 2.36 μm in the nucleus of ARP 220 is abnormally strong; it is suggested that this anomaly may be the result of starburst activity. However, in the large aperture spectra of ARP 220 and other starburst galaxies, the strength of the CO band is consistent with a normal stellar population typical of a spiral galaxy. This suggests that the stellar continuum associated with the starburst is very diluted by the normal population, a situation consistent with the starburst being mostly localised in the nucleus.

49799 (ESA-SP–290, pp. 481-488) **Hα emission lines in high redshift quasars.** Espey, B.R. (Cambridge Univ. (UK). Inst. of Astronomy); Ward, M.J.; Carswell, R.F.; Smith, M.G.; Bailey, J.A. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

We have obtained infrared spectra of the Hα lines in 18 medium to high redshift QSOs using the FIGS spectrometer at the Anglo-Australian Telescope, and nearly simultaneous optical spectra. We find that the Hα line is redshifted by an average of 1300 kms s^{-1} with respect to the lines from high ionization species such as CIV and that the low ionization lines such as OI and MgII are shifted by similar, or slightly smaller, amounts. These results are difficult to reconcile with any simple models currently available, but the similarity between the velocities of Hα and MgII, OI provides some support for models in which the Balmer lines are produced predominantly in a warm HI region, perhaps by X-ray heating, while the Lyman lines arise mainly in a population of optically thin clouds. We also present data on the change of Lyα/Hα with relative velocity.

49800 (ESA-SP–290, pp. 489-496) **The microwave background in steady-state cosmology.** Hoyle, F. (University Coll. of Swansea (UK)); Wickramasinghe, N.C. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

The form of the microwave background in strict steady-state cosmology necessarily differs from a black-body spectrum at millimetre wavelengths, and it does so in good agreement with recent astronomical data.

49801 (ESA-SP–290, pp. 497-500) **A search for the CO feature in active galactic nuclei.** Hunt, L. (European Southern Observatory, Garching (DE)); Melnick, J. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

We present multiaperture 2.1 - 2.5 μm CVF spectra of NGC 3227, NGC 4151, and NGC 2782. The CO feature is not detected in either NGC 4151 or NGC 2782, but is marginally detected in NGC 3227. In addition, the data suggest the presence of a weak radial gradient in the strength of the CO feature in NGC 3227.

49802 (ESA-SP–290, pp. 501-506) **Evolutionary synthesis of the far-infrared emission in starburst galaxies.** Mas-Hesse, J.M.M. (Universidad Complutense de Madrid (ES). Dept de Astrofisica); Kunth, D. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

We have used evolutionary population synthesis models to study the Far Infrared emission in star-forming galaxies. The dust particles are heated by the energetic photons originated in the young massive stars and reradiate the energy thermally in the FIR. Our models can explain the tight correlation between the FIR and the radio emission actually observed, considering both the thermal and the non-thermal contribution to the radio continuum. We have also studied the time evolution of the ratio FIR/LH β, which appears to be a good age indicator, complementary of other indicators as the H β equivalent width.

49803 (ESA-SP–290, pp. 507-510) **Infrared [FeII], H and H_2 lines in galaxy nuclei.** Moorwood, A.F.M. (European Southern Observatory, Garching (DE)); Oliva, E. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

We present some preliminary results of follow-up spectroscopic studies at R$\simeq$ 150 with IRSPEC at the ESO 3.6m telescope of [FeII], H_2 and hydrogen recombination line emission in selected galaxies from a sample of 35 ranging from pure HII region-like to Seyfert 1's previously surveyed in the [FeII](1.64μm), H_2 (1 OS(1)) at 2.121 μm and Brγ lines. The new observations include measurements of additional lines of diagnostic interest e.g the H_2 (2 1S(1)) line at 2.247 μm, improved linewidth determinations and some limited spatial mapping.

49804 (ESA-SP–290, pp. 511-516) **Infrared profiles of five spiral galaxies.** Prieto, M. (Instituto de Astrofisica de Canarias, Tenerife (ES)); Campos, Aguilar, A.; Garcia, C. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

We present radial profiles of five spiral galaxies (NGC 5194, NGC 3627, NGC 3351, NGC 5055, NGC 4736) in the J and K filters of the near infrared, taken with the 1.5 m Carlos Sanchez Telescope of the Observatorio del Teide, Tenerife. We have calculate the IR photometric parameters of the disk and bulge of NGC 5194 (M51), and have detected IR spiral arms in this grand-design galaxy. We also find that all these intermediate type spiral galaxies present characteristic bumps of IR emission near the center.

49805 (ESA-SP–290, pp. 517-520) **Fluorescent molecular hydrogen emission from star-forming galaxies.** Puxley, P. (Edinburgh Univ. (UK). Dept of Astronomy); Hawarden, T.; Mountain, M. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

Near-infrared molecular hydrogen emission has been detected from the central star-forming complexes in nearby spiral galaxies. In all cases, measurement of several transitions demonstrates than the bulk of the line-emitting gas is excited by UV radiation, and not by shocks. For most galaxies, the ratio of the molecular (v=1-0 S(1)) to atomic (Brγ) hydrogen line strengths can be quantitatively understood if the emitting regions consist of individual hot stars (or small clusters) embedded within the parent molecular clouds or forming blisters at their surface. Large central star clusters may account for the handful of galaxies which display relatively weak H_2 emission.

49806 (ESA-SP–290, pp. 521-524) **H53α emission from M82.** Puxley, P. (Edinburgh Univ. (UK). Dept. of Astronomy); Brand, P.; Moore, T.; Mountain, M.; Nakai, N.; Yamashita, T. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

The first detection of H53α emission from another galaxy has been made. At the frequency of this transition (43 GHz) spontaneous emission dominates and dust extinction can be completely ignored. The inferred photo-ionization rate is $N_{LyC} = 1.1 \times 10^{54}$ s^{-1}; a factor of 5 larger than estimates based on large-aperture Brα observations due to significant dust attenuation at 4 μm. Together with other data, this high value of the ionization rate has important implications for the allowed mass-range of stars present.

49807 (ESA-SP–290, pp. 525-530) **Far-infrared fine-structure lines in active galaxies.** Spinoglio, L. (Consiglio Nazionale delle Ricerche, Frascati (IT). Ist. di Fisica dello Spazio Interplanetario); Malkan, M.A. European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

The line fluxes of the far-infrared fine-structure ionic and atomic transitions in the narrow-line regions (NLRs) of active galaxies are predicted using a standard photoionization model. Using the observed H β flux of the Seyfert 2 galaxy NGC 1068, and assuming the standard conditions in active galaxies NLRs, it appears that [CII] 158μm, [OI] 63μm, [NIII] 57μm, [NII] 122μm and [OIII] 88μm and 52μm are all detectable at high resolution (R=10^4) with the Long Wavelength Spectrometer (LWS) on board of the next ESA satellite ISO.

49808 (ESA-SP–290, pp. 531-534) **The correlation between radio and far-infrared emission for disk galaxies.** Voelk, H.J. (Max-Planck-Institut fuer Kernphysik, Heidelberg (DE)). European Space Agency, 75 - Paris (France). Sep 1989. (CONF-8812137–: Workshop on infrared spectroscopy in astronomy, Salamanca (Spain), 7-9 Dec 1988). In *Infrared Spectroscopy in astronomy: Proceedings of the 22. Eslab Symposium.* Order Number DE91702111. Source: NTIS (US Sales Only), PC A99/MF A01.

A theory is proposed for the correlation of the nonthermal radio continuum emission with the far infrared (FIR) emission from disk galaxies. The spatially integrated emission from each galaxy is considered. Assuming that the source strengths for relativistic electrons and energetic (ionising) photons, respectively responsible for the radio synchrotron and the FIR emission, are both proportional

to the supernova rate, it is supposed that the energy source for the FIR emission is essentially instantaneously communicating to the radiating dust grains. The radiating energetic electrons, however, have a much longer life-time. Yet over the volumina surrounding the electron sources within which those particles, whose energies correspond to the observed synchrotron frequency, lose their energy due to combined inverse Compton and synchrotron loss, the galaxies act as a calorimeter for these particles. The calorimeter function a fortiori pertains to all higher energy electrons. Assuming the integral observation to encompass this volume, the radio luminosity is calculated approximately. Taking the electron spectra to be due to diffusive shock acceleration at supernova remnant shocks, the net dependence of the radio emission on the spatial average of the magnetic field strength B is rather weak.

49809 (IAE–4828-6) **Cosmic ray production in plasma z pinches.** Vlasov, V.P.; Zhdanov, S.K.; Trubnikov, B.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 9p. (In Russian). Order Number DE91600990. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

It was shown that the hypothesis on a production of galactic cosmic rays in plasma cosmic pinches leads to the spectrum of accelerated particles $dN/DE \approx E^{-\nu}$ with the index $\nu=1+\sqrt{3}$ close to the observed one $\nu_0=2.7$ and it makes the present hypothesis rather likely.

49810 (IAE–4840-1) **Unified geometric theory of gravitation and electromagnetism: 5. Gravitational collapse and scalar radiation.** Bryushinkin, S.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 8p. (In Russian). Order Number DE91600932. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The question about the scalar wave radiation in the gravitational collapse is considered in terms of a five-dimensional closed isotropic model describing the collapse of a star consisting of a dust-like matter with a scalar field. It is demonstrated that the explosion of the supernova SN 1987A must produce a flux of scalar radiation energy which could be identified by the present-day gravitational detectors. The possibility of the effect of the supernova outburst on the Sun and the Earth is discussed. 13 refs.; 2 figs.

49811 (ISAS-SP–10) **High energy particle experiment for the GEOTAIL mission: GEOTAIL HEP.** Institute of Space and Aeronautical Science, Sagamihara, Kanagawa (Japan). Sep 1989. 114p. Order Number DE90520427. Source: NTIS (US Sales Only), PC A06/MF A01.

The high energy particle experiment for GEOTAIL mission was designed to understand the particle acceleration mechanism, energy flow, boundary dynamics and magnetic reconnection mechanism in the geotail region, solar flare particle acceleration mechanism, the propagation mechanism through interplanetary space, and the origin, lifetime and propagation mechanism of cosmic ray heavy ions. In order to achieve these objectives, particle detectors, burst detectors, medium energy isotope telescopes and a high energy isotope telescope will be placed in the spacecraft which will be launched in 1992 as one of the spacecraft missions in the International Solar Terrestrial Physics program. With these detectors, electrons, protons and helium, carbon, silicon and iron particles will be detected. The characteristics and the main technique used for each instrument to observe high energy particles are summarized. The details of the scientific objectives, the basic principle of particle identification, the electronic system and data processing system, key parameter information, telemetry data formats, preflight and in-flight calibration method and data an analysis plan are described in this report. (K.I.).

49812 (ITF–88-86) **Geometrical and dynamical characteristics of the Earth, the Moon and Terrestrial planets. Part 1: 1.Topographic surfaces and Gravitational fields.** Kamenskij, K.K.; Kislyuk, V.S.; Yatskiv, Ya.S. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1988. 21p. (In Russian). Order Number DE91600926. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Some aspects of the methodology of planetary dynamics are discussed. The reference frames for planetary dynamics are considered and the classification of planetary figures is given. Modern determinations of the parameters of topographic and gravitational figures of the Earth, the Moon and terrestrial planets are summarized and some peculiarities of geometrical and dynamical characteristics of these celestial bodies are considered. 33 refs.; 7 tabs.

49813 (ITF–88-174) **Formation and dynamics of shell structures in the astrophysical systems under the accretion of gas on the source of wind activity.** Gnatyk, B.I.; Krol', V.A. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1989. 24p. (In Russian). Order Number DE91600962. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The equations describing the interaction of rapid wind from the gravitating source of wind activity with a gas, that accress onto it are described in the approximation of infinitely thin layer. The formation and dynamics of shells that arise this interaction are investigated with the help of the equations obtained. The equations of motion for accreting gas and accretion flow are investigated, too. 49 refs.

49814 (ITP–88-167) **Statistical characteristics of turbulence in giant molecular clouds. Part 1: 1. Spectra in inertial range.** Ogul'chansky, Ya.Yu. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1989. 21p. Order Number DE91600963. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Using the invariant group of transformations of equations for characteristic functional of turbulence in compressible medium the spectral characteristics in inertial range are obtained. The influence of magnetic field on the turbulent spectra is evaluated. The application of the results obtained to supersonical turbulence in giant molecular clouds is discussed. 42 refs.

49815 (ITP–88-168) **Statistical characteristics of turbulence in giant molecular clouds. Part 2: 2. Clump properties.** Ogul'chanskij, Ya.Yu. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1989. 17p. Order Number DE91600964. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The statistical characteristics of clumps in giant molecular clouds are calculated with the help of assumption of self-similar spectrum for density logarithm fluctuations in isothermal compressible turbulent medium. The theory of peaks of Gaussian random field is used. The small space filling factor obtained (10^{-2}+10^{-3}) is well-correlated with observations. 19 refs.; 2 figs.

49816 (ITP–89-4) **Mutual coherent properties of the images of the quasar microlensed by star mass.** Verkhoglyadova, O.P.; Mandzhos, A.V. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1988. 21p. Order Number DE91600933. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The paper investigates the problem of mutual coherence of the radiation from two quasar images formed by a single point-mass gravitational lens with the mass of the order of solar mass. The expression for coherence degree is derived by asymptotic expansion in frequency. The coherence degree magnitude attains, in some cases, the values of 0.01-0.02 in the radio-frequency range. 9 refs.; 2 figs.; 2 tabs.

49817 (LA–11882-MS) **Discussion paper on environmental hazards on the Moon, in low Earth orbit, and in low Mars orbit.** Heiken, G. (comp.). Los Alamos National Lab., NM (USA). Sep 1990. 9p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. Order Number DE90017854. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In a lunar base era, potential problems with dust will be serious. Lunar soils, which make up most of the regolith that covers the Moon's surface, are similar to silty sands on Earth, with mean grain sizes of 45–100 μm. Lunar dust has very low electrical conductivity and dielectric losses, permitting accumulation of electric charge under ultraviolet irradiation. Dust coatings cover thermally-sensitive surfaces, windows and visors, clog moving parts, and create continual abrasion hazards. Reduced gravity on the Moon favors the stability of aerosolized lunar soil and thereby will prolong its availability for inhalation if it is not removed from habitat atmosphere by

filtration systems. Some of the other hazards that must be considered include: Perception; on the lunar surface it is difficult to judge topographic details and distances, and Micrometeoroid impact; new materials are needed to protect astronauts and equipment at a lunar base. Spacecraft in low orbits around Earth and Mars experience strong chemical interactions where O_2 and CO_2 are photodissociated by sunlight. A ground-based facility at Los Alamos can be used to test these chemical interactions with materials proposed for use in spacecraft and satellites. Another component of the space exploration initiative is the environmental effects posed by man on the tenuous lunar and martian atmospheres. Before significant development occurs on these planets, these atmospheres must be measured. Orbiting sensors designed to measure these atmospheres can also be used to search for water.

49818 (N–90-24120) **Baryogenesis in extended inflation. Part 1: Baryogenesis via production and decay of supermassive bosons.** Barrow, J.D.; Copeland, E.J.; Kolb, E.W.; Liddle, A.R. Sussex Univ., Brighton (UK). May 1990. 20p. (NASA-CR–180615;NAS–1.26:180615). Source: NTIS, PC A03/MF A01.

Baryogenesis occurring during the thermalization stage at the end of extended inflation is considered. In extended inflation, the Universe passes through a first-order phase transition via bubble nucleation; inflation comes to an end when bubbles collide and their collisions convert energy stored in the bubble walls into particles. This naturally provides conditions well out of thermal equilibrium in which baryon number violating processes may proceed; the amount of baryon asymmetry which may be produced this way is estimated. The avoidance of a monopole or domain wall problem can also be ensured and isothermal density perturbations may arise as a remnant of spatial variation in the baryon asymmetry.

49819 (N–90-24122) **Periodic signatures for the detection of cosmic axions.** Turner, M.S. Fermi National Accelerator Lab., Batavia, IL (USA). May 1990. 10p. (NASA-CR–186608;NAS–1.26:186608;FERMILAB-PUB–90/89-A). Source: NTIS, PC A02/MF A01.

In a Sikivie-type cosmic-axion detector, both the width and position of the microwave signal due to axion-photon conversion depend upon the motions of the earth. Due to the orbital and rotational motions of the earth they will be modulated with periods of 1 sidereal day and 1 sidereal year, with amplitudes of about 0.1 percent and 5 percent respectively. Because of the intrinsically-high energy resolution of Sikivie-type detectors such periodic variations should be detectable. Such modulations would not only aid in confirming the detection of cosmic axions, but, if found, would also provide important information about the distribution of axions in the halo.

49820 (N–90-24123) **Cosmological baryon and lepton number in the presence of electroweak fermion-number violation.** Harvey, J.A.; Turner, M.S. Chicago Univ., IL (USA). Mar 1990. 12p. (NASA-CR–186609;NAS–1.26:186609;FERMILAB-PUB–90/49-A;EFI–90-33). Source: NTIS, PC A03/MF A01.

In the presence of rapid fermion-number violation due to nonperturbative electroweak effects certain relations between the baryon number of the Universe and the lepton numbers of the Universe are predicted. In some cases the electron-neutrino asymmetry is exactly specified in terms of the baryon asymmetry. Without introducing new particles, beyond the usual quarks and leptons, it is necessary that the Universe possess a nonzero value of B - L prior to the epoch of fermion-number violation if baryon and lepton asymmetries are to survive. Contrary to intuition, even though electroweak processes violate B + L, a nonzero value of B + L persists after the epoch of rapid fermion-number violation. If the standard model is extended to include lepton-number violation, for example through Majorana neutrino masses, then electroweak processes will reduce the baryon number to zero even in the presence of an initial B - L unless 20 M_L approximately greater than the square root of (T_{B-L} m_{Pl}) where M_L sets the scale of lepton number violation and T_{B-L} is the temperature at which a B - L asymmetry is produced. In many models this implies that neutrinos must be so light that they cannot contribute appreciably to the mass density of the Universe.

49821 (N–90-24211) **Evolution of light domain walls interacting with dark matter, part 1.** Massarotti, A. Chicago Univ., IL (USA). Apr 1990. 19p. (NASA-CR–181123;NAS–1.26:181123;FERMILAB-PUB–90/77-A). Source: NTIS, PC A03/MF A01.

The evolution of domain walls generated in the early Universe is discussed considering an interaction between the walls and a major gaseous component of the dark matter. The walls are supposed able to reflect the particles elastically and with a reflection coefficient of unity. A toy Lagrangian that could give rise to such a phenomenon is discussed. In the simple model studied, highly nonrelativistic and slowly varying speeds are obtained for the domain walls (approximately 10 (exp -2)(1+z)(exp -1)) and negligible distortions of the microwave background. In addition, these topological defects may provide a mechanism of forming the large scale structure of the Universe, by creating fluctuations in the dark matter (delta rho/rho approximately O(1)) on a scale comparable with the distance the walls move from the formation (in the model d less than 20 h(exp -1) Mpc). The characteristic scale of the wall separation can be easily chosen to be of the order of 100 Mpc instead of being restricted to the horizon scale, as usually obtained.

49822 (N–90-24213) **Thermal relics: Do we know their abundances.** Kamionkowski, M.; Turner, M.S. Illinois Univ., Chicago, IL (USA). May 1990. 31p. (NASA-CR–183334;NAS–1.26:183334;FERMILAB-PUB–90/97-A). Source: NTIS, PC A03/MF A01.

The relic abundance of a particle species that was once in thermal equilibrium in the expanding Universe depends upon a competition between the annihilation rate of the species and the expansion rate of the Universe. Assuming that the Universe is radiation dominated at early times the relic abundance is easy to compute and well known. At times earlier than about 1 sec after the bang there is little or no evidence that the Universe had to be radiation dominated, although that is the simplest and standard assumption. Because early-Universe relics are of such importance both to particle physics and to cosmology, three nonstandard possibilities are considered in detail for the Universe at the time a species' abundance froze in: energy density dominated by shear (i.e., anisotropic expansion), energy density dominated by some other nonrelativistic species, and energy density dominated by the kinetic energy of the scalar field that sets the gravitational constant in a Brans-Dicke-Jordan cosmological mode. In the second case the relic abundance is less than the standard value, while in the other two cases it can be enhanced by a significant factor. Two other more exotic possibilities for enhancing the relic abundance of a species are also mentioned–a larger value of Newton's constant at early times (e.g., as might occur in superstring or Kaluza-Klein theories) or a component of the energy density at early times with a very stiff equation of state (p greater than rho/3), e.g., a scalar field phi with potential V(phi) = Beta /phi/(exp n) with n greater than 4. Results have implications for dark matter searches and searches for particle relics in general.

49823 (N–90-24214) **Classical theory of radiating strings.** Copeland, E.J.; Haws, D.; Hindmarsh, M. Sussex Univ., Brighton (UK). Jun 1990. 12p. (NASA-CR–186607;NAS–1.26:186607;FERMILAB-PUB–90/119-A). Source: NTIS, PC A03/MF A01.

The divergent part of the self force of a radiating string coupled to gravity, an antisymmetric tensor and a dilaton in four dimensions are calculated to first order in classical perturbation theory. While this divergence can be absorbed into a renormalization of the string tension, demanding that both it and the divergence in the energy momentum tensor vanish forces the string to have the couplings of compactified N = 1 D = 10 supergravity. In effect, supersymmetry cures the classical infinities.

49824 (N–90-24881) **Axions and SN 1987A: Axion trapping.** Burrows, A.; Ressell, M.T.; Turner, M.S. Arizona Univ., Tucson, AZ (USA). May 1990. 30p. (NASA-CR–186604;NAS–1.26:186604;FERMILAB-PUBL–90/81-A). Source: NTIS, PC A03/MF A01.

If an axion of mass between about 10(exp -3) eV and 1 eV exists, axion emission would have significantly affected the cooling of the nascent neutron star associated with SN 1987A. For an axion

of mass less than about 10(exp -2) eV, axions produced deep inside the neutron star simply stream out; in a previous paper this case has been addressed. Remarkably, for an axion of mass greater than about 10(exp -2) eV axions would, like neutrinos, have a mean-free path that is smaller than the size of a neutron star, and thus would become trapped and radiated from an axion sphere. In this paper the trapping regime is treated by using numerical models of the initial cooling of a hot neutron star that incorporate a leakage approximation scheme for axion-energy transport. The axion opacity is computed due to inverse nucleon-nucleon, axion bremsstrahlung, and numerical models are used to calculate the integrated axion luminosity, the temperature of the axion sphere, and the effect of axion emission on the neutrino bursts detected by the Kamiokande 2 (K2) and Irvine-Michigan-Brookhaven (IMB) water-Cherenkov detectors. The larger the axion mass, the stronger the trapping and the smaller the axion luminosity. The earlier estimate is confirmed and refined of the axion mass above which trapping is so strong that axion emission does not significantly affect the neutrino burst. Based upon the neutrino-burst duration–the most sensitive barometer of axion cooling–it is concluded that for an axion mass of greater than about 0.3 eV, axion emission would not have had a significant effect on the neutrino bursts detected by K2 and IMB. The present work, together with the previous work, strongly suggests that an axion with mass in the interval 10(exp -3) eV to 0.3 eV is excluded by SN 1987A.

49825 (PSC–6) **High-energy protons produced by a large-amplitude magnetosonic wave and associated gamma radiation through neutral pion decay.** Ohsawa, Y.; Terashima, Y. Nagoya Univ. (Japan). Plasma Science Center. Feb 1990. 37p. Order Number DE90520190. Source: NTIS (US Sales Only), PC A03/MF A01.

Spectra of ions accelerated by a large-amplitude magnetosonic wave and spectra of gamma radiation from the decay of neutral pions which are produced in energetic ion collisions are studied through particle simulations and numerical calculations. A large-amplitude magnetosonic wave can promptly accelerate ions to relativistic energies for a rather strong magnetic field ($\omega_{ce} >$ or approx. ω_{pe}). This acceleration is much more rapid and efficient than usual stochastic acceleration and can occur in solar flares. Ion spectra thus generated can have various shapes depending on some plasma parameter. The maximum energy is, however, well defined, and ion spectra have strong downward curvatures near the maximum values. Further, a particle simulation shows that this mechanism can produce a (truncated) power-law form with a spectral index s = 1.2. Energy spectra of gamma radiation are then numerically obtained for this type of ion energy spectrum and for the modified Bessel function forms derived from a stochastic acceleration model. Power-law forms of ion spectra produce much harder photon energy-spectra than the modified Bessel function forms. (author).

49826 (SAAO–14) **The South African Astronomical Observatory.** South African Astronomical Observatory, Cape Town (South Africa). 1989. 41p. Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the period 1989 January 1 to October 31.

The research work discussed in this report covers a wide range, from work on the nearest stars to studies of the distant quasars, and the astronomers who have carried out this work come from universities and observatories spread around the world as well as from South African universities and from the South African Astronomical Observatory (SAAO) staff itself. A characteristic of much of this work has been its collaborative character. SAAO studies in 1989 included: supernovae 1987A; galaxies; ground-based observations of celestial x-ray sources; the Magellanic Clouds; pulsating variables; galactic structure; binary star phenomena; the provision of photometric standards; nebulous matter; stellar astrophysics, and astrometry.

49827 (SAAO–14, pp. 22-26) **Stellar astrophysics.** South African Astronomical Observatory, Cape Town (South Africa). 1989. In *The South African Astronomical Observatory.* Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the period 1989 January 1 to October 31.

The existence of extremely pure mono-elemental atmospheres in most white dwarfs is well understood. Attention is now focused on the few exceptions. An analysis was made at the South African Astronomical Observatory (SAAO) of an unusual white dwarf whose atmosphere contains various metallic elements. Other stellar studies conducted by the SAAO include research on: T Tauri stars; hydrogen-deficient stars and RCB variables; flare stars and RS CVn stars; B[e] stars; the periodicity of Be star variations; Wolf-Rayet stars; IRAS sources; Hind's star; masses of AGB stars and their descendent white dwarfs, and carbon and S-type stars. 4 figs.

49828 (SAAO–14, pp. 21-22) **Nebulous matter.** South African Astronomical Observatory, Cape Town (South Africa). 1989. In *The South African Astronomical Observatory.* Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the period 1989 January 1 to October 31.

Short note. NEBULAE/star evolution; NEBULAE; PLANETARY NEBULAE; VELOCITY

49829 (SAAO–14, pp. 19-21) **Binary star phenomena.** South African Astronomical Observatory, Cape Town (South Africa). 1989. In *The South African Astronomical Observatory.* Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the period 1989 January 1 to October 31.

Novae are of considerable current interest to astronomers, both for the understanding of the physics of the nova outburst and for their use as extragalactic distance indicators. Studies of several novae in the galaxy have been made at the South African Astronomical Observatory (SAAO) in recent years, including a study of Nova Mus 1983. The SAAO has also been involved in studies of the interacting binary white dwarf system V803 Cen. 5 figs.

49830 (SAAO–14, pp. 13-17) **Pulsating variables.** South African Astronomical Observatory, Cape Town (South Africa). 1989. In *The South African Astronomical Observatory.* Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the period 1989 January 1 to October 31.

The study of stellar pulsations is a major route to the understanding of stellar structure and evolution. At the South African Astronomical Observatory (SAAO) the following stellar pulsation studies were undertaken: rapidly oscillating Ap stars; solar-like oscillations in stars; 8-Scuti type variability in a classical Am star; Beta Cephei variables; a pulsating white dwarf and its companion; RR Lyrae variables and galactic Cepheids. 4 figs.

49831 (SAAO–14, pp. 6-7) **Supernova 1987A in the Large Magellanic Cloud.** South African Astronomical Observatory, Cape Town (South Africa). 1989. In *The South African Astronomical Observatory.* Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the period 1989 January 1 to October 31.

SN1987A, the supernova in the Large Magellanic Cloud, is now an inconspicuous object at optical wavelengths. However it remains of exceptional interest since observations can be made of the transition from supernova to supernova remnant. The photometric data show not only that dust formed within the ejecta but that it was concentrated in dense clumps. 4 figs.

49832 (SAAO–14, pp. 10-13) **Ground-based observations of celestial x-ray sources.** South African Astronomical Observatory, Cape Town (South Africa). 1989. In *The South African Astronomical Observatory.* Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the period 1989 January 1 to October 31.

A combination of space-based x-ray observations with ground-based optical work is a very fruitful way of studying those binary star systems where the two components are so close together that they exchange matter. The results of a four-day simultaneous optical and x-ray observation of a celestial x-ray source, conducted by the South African Astronomical Observatory (SAAO), show that optical radiation is not simply reprocessed X-rays and that the optical

and x-ray fluxes are correlated. Other x-ray emitting, interacting binaries studied at SAAO are intermediate polars and the AM Her System V834 Cen. 3 figs.

49833 (SAAO–14, pp. 17-19) **Galactic structure.** South African Astronomical Observatory, Cape Town (South Africa). 1989. In *The South African Astronomical Observatory*. Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the period 1989 January 1 to October 31.

The occurrence of hot, apparently normal, massive stars far from the galactic plane has been a major puzzle in an understanding of galactic structure and evolution. Such stars have been discovered and studied at the South African Astronomical Observatory (SAAO) over a number of years. During 1989 further evidence has been obtained indicating that these stars are normal, massive objects. Other studies of galactic structure conducted by the SAAO have included research on: the central bulge region of our galaxy; populations of M giants in the galaxy; a faint blue object survey; a survey of the galactic plane for distant Cepheid variables; interstellar reddening, and K-type dwarfs as tracers for the gravitational force perpendicular to the galactic plane. 1 fig.

49834 (SAAO–14, pp. 12-13) **The Magellanic clouds.** South African Astronomical Observatory, Cape Town (South Africa). 1989. In *The South African Astronomical Observatory*. Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the period 1989 January 1 to October 31.

As the two galaxies nearest to our own, the Magellanic Clouds hold a special place in studies of the extragalactic distance scale, of stellar evolution and the structure of galaxies. In recent years, results from the South African Astronomical Observatory (SAAO) and elsewhere have shown that it is possible to begin understanding the three dimensional structure of the Clouds. Studies of Magellanic Cloud Cepheids have continued, both to investigate the three-dimensional structure of the Clouds and to learn more about Cepheids and their use as extragalactic distance indicators. Other research undertaken at SAAO includes studies on Nova LMC 1988 no 2 and red variables in the Magellanic Clouds.

49835 (SAAO–14, pp. 7-10) **Galaxies.** South African Astronomical Observatory, Cape Town (South Africa). 1989. In *The South African Astronomical Observatory*. Source: Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa.

Report for the period 1989 January 1 to October 31.

In studies of the large scale structure of the universe there is a continuing need for extensive galaxy redshift determinations. Optically selected redshift surveys are of particular importance, since flux-limited samples record much higher space densities of galaxies than samples of similar size selected in other wavebands. A considerable amount of the South African Astronomical Observatory (SAAO) observing time is currently being devoted to carrying out a large southern galaxy redshift survey. A recently completed study, the Durham-SAAO redshift survey suggests that the mean density of matter is well below the critical limit for a closed universe and also that the universe may be homogenous at very large scales. Other research conducted by the SAAO include studies on: the distribution of galaxies; Seyfert galaxies; starburst and IRAS galaxies; interacting and compact galaxies; a re-evaluation of the Cepheid distance to NGC 300, and a search for quasars behind galaxies. 1 fig.

49836 (UCRL-JC–104223-Rev.1) **A new site for the astrophysical gamma-process: Revision 1.** Howard, W.M. (Lawrence Livermore National Lab., CA (USA)); Meyer, B.S.; Woosley, S.E. Lawrence Livermore National Lab., CA (USA). May 1990. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9006212–3-Rev.1: International symposium on nuclear astrophysics: nuclei in the cosmos, Vienna (Austria), 18-22 Jun 1990). Order Number DE90017519. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In this paper we propose that the requisite thermodynamic conditions may occur in Type Ia supernovae, when carbon-oxygen white dwarfs explode by deflagration. The cores of such stars have undergone extensive s-processing during helium flashes to provide sufficient s-process seeds for the light p-isotopes. When these stars undergo a deflagration disruption, these s-process isotopes can be transmuted into p-isotopes in the mass region of the core where the deflagration flame is extinguished and the temperatures approach the range $2.4 \lesssim T_9 \lesssim 3.2$. At these temperatures the enhanced s-process seeds are efficiently transmuted into p-isotopes on a timescale of less than 1 sec. To examine this astrophysical site, we calculate the nucleosynthesis that takes place when such mass zones are heated by the deflagration wave and then expand and compare our results with the solar-system distribution of the p-isotopes. 12 refs., 1 fig.

49837 Observations of Cygnus X-2 with IUE: Ultraviolet results from a multiwavelength campaign. Vrtilek, S.D.; Raymond, J.C.; Garcia, M.R.; Verbunt, F.; Hasinger, G.; Kuerster, M. 42p. Fachinformationszentrum Karlsruhe, Eggenstein-Leopoldshafen (DE) (1989).

The observations of the low-mass x ray binary, Cyg X-2, taken with the International Ultraviolet Explorer (IUE) in a campaign conducted in June and October of 1988 are reported. A direct relationship between the strength of the UV continuum and line emission and the placement of the x ray spectrum in one of three branches of the so-called Z-shaped curve is found by comparison with simultaneous x ray observations. All three previously known x ray spectral states are detected; the UV continuum and line emission increase monotonically along the Z with the least emission in the horizontal branch, and the most in the flaring branch. Emission lines due to HeII, CIV, NIII, NIV, NV, SiIV, and MgII are observed.

49838 A model for the distribution of dark matter, galaxies, and the intergalactic medium in a cold dark matter-dominated universe. Ryu, D. (Fermi National Accelerator Lab., Batavia, IL (USA)); Vishniac, E.T.; Chiang, W.H. pp. 228-238 of Proceedings of the fourteenth Texas symposium on relativistic astrophysics: Volume 571. Fenyves, E.J. The New York Academy of Sciences, New York, NY (USA) (1989). (CONF-881268–: 14. Texas symposium on relativistic astrophysics, Dallas, TX (USA), 11-16 Dec 1988).

Until now, most studies on the cold dark matter (CDM) universe have considered only the distribution of the dark matter and compared that with the observed distribution of galaxies. Even though the dark matter determines the overall dynamics of the large-scale structure, galaxies form out of the baryonic matter whose density and velocity distributions can be different from those of the dark matter, depending on the thermal history of the universe. In this paper, the authors study both the dark matter component and the baryonic component, that is, galaxies and the IGM, with several simplifying assumptions, by explicitly following the evolution. The dark matter, galaxies, and IGM are coupled through gravity; galaxies form out of the IGM by taking mass and momentum, whereas the IGM responds to the energy input from the galaxies.

49839 Primeval and rejuvenated galaxies: A new approach to the search for them. Ozernoy, L.M. (Los Alamos National Lab., NM (USA)). pp. 219-227 of Proceedings of the fourteenth Texas symposium on relativistic astrophysics: Volume 571. Fenyves, E.J. The New York Academy of Sciences, New York, NY (USA) (1989). (CONF-881268–: 14. Texas symposium on relativistic astrophysics, Dallas, TX (USA), 11-16 Dec 1988).

Close interactions between primeval galaxies including mergings could play a decisive role in their early history. These interactions result in a thermal continuum radiation spectrum expected to peak in the far infrared at $\lambda_0 \sim 100$ μm (in the rest frame), which is roughly independent of whether the grain temperature is determined by the radiation of OB stars or by the dissipation of kinetic energy in galaxy-galaxy collisions. The author discusses how such a peak redshifted to submillimeter wave range could be an observational signature of both primeval and rejuvenated galaxies. Detection of those peaks would provide valuable clues to the origin of galaxies and open tremendous prospects for observational cosmology.

49840 The great supernova of 1987. Woosley, S.E. (California Univ., Santa Cruz, CA (USA)). pp. 397-413 of Proceedings of the fourteenth Texas symposium on relativistic astrophysics: Volume 571. Fenyves, E.J. The New York Academy of Sciences, New

York, NY (USA) (1989). Grant AST-84-18185. (CONF-881268–: 14. Texas symposium on relativistic astrophysics, Dallas, TX (USA), 11-16 Dec 1988).

Seven hundred day after the explosion of the brightest supernova in four centuries, astronomers continue to be both excited and perplexed by its behavior. By now, the supernova has received considerably attention in the literature. This paper emphasizes several aspects of the supernova that continue to be of special interest. These include: the evolution of the presupernova star, why it was blue, what its composition and core structure were; the iron core mass, explosion mechanism, and certain aspects of the neutrino burst; the detailed isotopic composition of the ejecta; the light curve and the requirement for mixing; the expected continued evolution of the supernova at all wavelengths given both the presence of several radioactivities as well as a central collapsed object as a power source; and late breaking news regarding the pulsar.

49841 Self-sustained mechanism of mass transfer and evolution of very low mass x-ray binaries. Tavani, M. (Lawrence Livermore National Lab., CA (USA)); Kluzniak, W.; Ruderman, M.; Shaham, J. pp. 427-430 of Proceedings of the fourteenth Texas symposium on relativistic astrophysics: Volume 571. Fenyves, E.J. The New York Academy of Sciences, New York, NY (USA) (1989). (CONF-881268–: 14. Texas symposium on relativistic astrophysics, Dallas, TX (USA), 11-16 Dec 1988).

The discovery of the eclipsing millisecond pulsar PSR 1957 + 20 provides evidence that the evolution of some low-mass x-ray binaries (LMXBs) may be driven by radiation from their primary neutron stars. The observation of a strong outflowing wind from the very low mass ($m \simeq 0.02\ M_{\odot}$) degenerate dwarf companion underfilling its Roche lobe supports a theoretical evolutionary scenario (proposed even before the discovery of PSR 1957 + 20) that can lead to such a final state. In earlier evolutionary stages, high-rate mass transfer in LMXBs could be driven by radiation (x-rays) and/or ~ 1-MeV γ rays) illuminating the secondary, which self-sustains a (bootstrap) mass transfer at rates close to the neutron star's Eddington limit. Bootstrapped mass transfer could control the binary evolution even when gravitational radiation or other mechanisms for removing angular omentum from the system (e.g., magnetic braking) would produce only a small mass loss rate.

49842 The 1973 x-ray outburst of 4U1145-61. Terrell, J. (Los Alamos National Lab., NM (USA)). pp. 534-538 of Proceedings of the fourteenth Texas symposium on relativistic astrophysics: Volume 571. Fenyves, E.J. The New York Academy of Sciences, New York, NY (USA) (1989). (CONF-881268–: 14. Texas symposium on relativistic astrophysics, Dallas, TX (USA), 11-16 Dec 1988).

This paper reports on the Vela 5B spacecraft, launched on 23 May 1969. It was the first spacecraft capable of long-term x-ray astronomy. It surveyed the entire x-ray sky, in the 3–12 keV range, for the unprecedented period of 10 years, finally ceasing operation on 19 June 1979. The scintillator-photomultiplier detector, collimated to 6.1° x 6.1 ° (FWHM), was pointed at 90° to the earth-oriented spin axis of the spacecraft. Thus, Vela 5B scanned a great circle of the sky during each 64-second rotation and mapped the x-ray sky twice in each 112-hour orbit. Individual sources were in view for several hours in each 56-hour period.

49843 Distance limits for gamma-ray bursts from galactic neutron stars. Hartmann, D. (California Univ., Santa Cruz, CA (USA)). pp. 532-533 of Proceedings of the fourteenth Texas symposium on relativistic astrophysics: Volume 571. Fenyves, E.J. The New York Academy of Sciences, New York, NY (USA) (1989). Grant AST-88-13649. (CONF-881268–: 14. Texas symposium on relativistic astrophysics, Dallas, TX (USA), 11-16 Dec 1988).

To date, more than ~ 400 γ-ray burst events have been recorded by detectors aborad widely separated spacecraft, but their origin remains a mystery. Their positions in the sky exhibit a high degree of isotropy and they do not show any evidence of angular clustering on scales between 1° and 100°. Their brightness distribution is consistent with sources drawn from a spatially homogeneous parent population. No counterpart to a γ-ray burst source has yet been unambiguously identified in any wavelength band. This paper discusses how these observational facets have left the distance scale of γ-ray bursts undetermined and we are faced with the great debate about the galactic or extragalactic origin of this extraordinary phenomenon.

49844 The intermediate-degree g-mode spectrum of the sun: its properties and their implications to the solar neutrino paradox. Rabaey, G.F. (Arizona Univ., Tucson, AZ (USA). Dept. of Physics); Hill, H.A. pp. 594-600 of Proceedings of the fourteenth Texas symposium on relativistic astrophysics: Volume 571. Fenyves, E.J. The New York Academy of Sciences, New York, NY (USA) (1989). (CONF-881268–: 14. Texas symposium on relativistic astrophysics, Dallas, TX (USA), 11-16 Dec 1988).

The intermediate-degree gravity modes ($l = 30$) that reside in the region, $0.05 < r/R_{\odot} < 0.45$, of the sun provide a useful observational tool for probing the solar interior. The first evidence of the excitation of long-period solar oscillations (frequencies between ~ 250 μHz and 1.7 mHz) was obtained in the 1970s. In 1979 evidence was found that indicated the excitation of a number of gravity modes with frequencies between ~ 250 μHz and ~ 400 μHz during an examination of the 1973 solar diameter observations taken at SCLERA. However, it was not until 1986 that a researcher identified and made preliminary classifications of a set of four intermediate-degree gravity-mode multiplets using 1979 differential radius observations. These four multiplets were found to have $m = 0$ eigenfrequencies of $\nu_N \approx 350$ μHz and a classified $l = 30$, where n is the radial eigenvalue radial order), l is the angular eigenvalue (angular degree), and m is the azimuthal eigenvalue (angular order). These modes also were observed to the mode-coupled (phase-locked). The properties of these four multiplets (and, in particular, the properties of the multiplet tentatively classified as $n = 15$, $l = 30$) have been used as a starting point for an extensive study of the intermediate-degree g-modes in the 240–250 μHz region of the power spectra. The results of this analysis are presented and the relevance to the solar neutrino paradox is discussed.

49845 Status of solar neutrino observations and prospects for future experiments. Lande, K. (Westinghouse Electric Corp., Concordville, PA (USA). Combustion Turbine Engineering Dept.). pp. 553-560 of Proceedings of the fourteenth Texas symposium on relativistic astrophysics: Volume 571. Fenyves, E.J. The New York Academy of Sciences, New York, NY (USA) (1989). (CONF-881268–: 14. Texas symposium on relativistic astrophysics, Dallas, TX (USA), 11-16 Dec 1988).

For the past twenty years, an experiment in the Homestake Gold Mine in Lead, South Dakota, has been engaged in the measurement of the neutrino flux emitted by fusion reactions in the core of the sun. Within the past two years, a second detector, located at Kamioka, Japan, has also observed these neutrinos and has verified the Homestake neutrino flux measurements. Therefore, it has now been experimentally demonstrated that fusion reactions indeed occur in the sun. The observed flux is a factor of three to four smaller than that predicted by the standard solar model (SSM). In this report the author presents the results of the present experiments, describes several new experiments that should be operational within the coming year or so, and discusses suggestions for the difference between the observed and predicted solar neutrino fluxes.

49846 Thermal Comptonization models for gamma-ray emission from black-hole sources. Dermer, C.D. (Lawrence Livermore National Lab., CA (USA). Physics Dept.). pp. 513-521 of Proceedings of the fourteenth Texas symposium on relativistic astrophysics: Volume 571. Fenyves, E.J. The New York Academy of Sciences, New York, NY (USA) (1989). DOE Contract W-7405-ENG-48. (CONF-881268–: 14. Texas symposium on relativistic astrophysics, Dallas, TX (USA), 11-16 Dec 1988).

The salient features associated with gamma-ray emission from the above-mentioned sources are summarized, beginning with Cygnus X-1, which is the best-studied black-hole candidate. Because of similarity in properties, models developed to explain the x-ray and gamma-ray observations of Cygnus X-1 can be equally applied to AGN. In this review, successes and limitations of thermal Comptonization models for the high-energy emission of black-hole sources are considered. Such models were proposed a dozen years ago to explain the shape of the x-ray spectra of these objects, but have undergone considerable theoretical development

in the past decade in order to be extended to gamma-ray energies. Models associated with monoenergetic electron injection followed by a pair cascade, shock acceleration, the Penrose–Compton mechanism, or pion production from nonthermal proton distributions are not treated here.

49847 The steady state solutions of radiatively driven stellar winds for a non-Sobolev, pure absorption model. Poe, C.H. (High Altitude Observatory, Boulder, CO (USA)); Owocki, S.P.; Castor, J.I. *Astrophysical Journal (USA),* 358: 199-213 (Jul 1990).

The steady state solution topology for absorption line-driven flows is investigated for the condition that the Sobolev approximation is not used to compute the line force. The solution topology near the sonic point is of the nodal type with two positive slope solutions. The shallower of these slopes applies to reasonable lower boundary conditions and realistic ion thermal speed v(th) and to the Sobolev limit of zero of the usual Castor, Abbott, and Klein model. At finite v(th), this solution consists of a family of very similar solutions converging on the sonic point. It is concluded that a non-Sobolev, absorption line-driven flow with a realistic values of v(th) has no uniquely defined steady state. To the extent that a pure absorption model of the outflow of stellar winds is applicable, radiatively driven winds should be intrinsically variable. 34 refs.

49848 Thermal relaxation oscillations in horizontal-branch stars. Salati, P. (California Univ., Berkeley (USA)); Raffelt, G.; Dearborn, D. *Astrophysical Journal (USA),* 357: 566-572 (Jul 1990).

In a recent numerical investigation of the effect of trapped cosmions on horizontal-branch (HB) stars, thermal pulses were observed to occur if the energy transfer provided by these weakly interacting particles was chosen to be efficient enough to break convection. A simple analytic two-zone model of the core of an HB star is presented which allows the interpretation of these pulsations as oscillations of thermal relaxation between the small energy generating nuclear core and the overlying gravothermal buffer. It is shown that any novel form of energy transfer which breaks convection will lead to this behavior where the usual stellar conductive equilibrium is replaced by a limit cycle. The star follows this cycle, oscillating with a period roughly given by the Kelvin-Helmholtz time scale of the core. 20 refs.

49849 Isocurvature baryon-dominated open universe - Structure of galactic halos. Hoffman, Yehuda (Technion - Israel Institute of Technology, Haifa (Israel)). *Astrophysical Journal (USA),* 357: L5-L7 (Jul 1990).

Structure of galactic halos in the isocurvature baryon-dominated open universe models is calculated. The halos' rotation curves are calculated analytically, based on the secondary infall paradigm. The nonvanishing curvature of the expanding universe introduces scale dependence of final virial structure of the halos, assuming they are formed dissipationlessly by hierarchical clustering. For primordial scale-free power spectra, with a spectral index in the range of n = 0 to -1, and Omega(0) of about 0.1, the predicted galactic halos rotation curves are found to be steeply decreasing with radius. Given the observed amplitude and extent of the rotation curves of giant spiral galaxies and the nucleosynthesis bounds on the baryon mean density, the allowed range of parameters yields only halos with falling rotation curves, in clear disagreement with the observed flat galactic rotation curves. 33 refs.

6402 Atmospheric Physics

Refer also to citation(s) 49361, 49362

49850 (AD-A–222554/8/XAB) **Thermosphere-Ionosphere coupling: An experiment in interactive modeling.** Forbes, J.M.; Roble, R.G. Boston Univ., MA (USA). 1 Jan 1990. 8p. Contract F49620-88-C-0111. Source: NTIS, PC A02/MF A01.

Pub. in Jnl. of Geophysical Research, Vol. 95, No. A1, 201-208(1 Jan 1990).

The NCAR thermosphere general circulation model (TGCM) is used to perform a series of controlled experiments aimed at better understanding the interactive coupling between ionospheric plasma densities and thermospheric neutral winds. The experiments are simple and controlled to facilitate identification of governing mechanisms. The interaction is accomplished by parameterizing the F layer peak height (hmF2) in an empirical ionospheric model in terms of the meridional wind (Vsouth) and forcing hmF2 and Vsouth to remain mutually coupled in a dynamic calculation. Interactive computations are performed where the TGCM is driven by 30-kV and 90-kV cross polar cap potentials and are compared with corresponding reference simulations where hmF2 is constrained to a balance height near 280 km with a small (about 20 km) diurnal variation. Mutual coupling between hmF2 and Vsouth is found to be weak during the daytime when the F layer exhibits a broad vertical structure. At night, when the F2 layer is more localized, the neutral dynamic structure is dependent on whether hmF2 is significantly above or below the altitude (approximately 275-300 km) at which ion drag effectively competes with viscosity in the neutral momentum balance. At Arecibo during both levels of high-latitude forcing the premidnight elevation (+75 km) of hmF2 relative to a nighttime height of approximately 290 km is accompanied by an increase (about 50 m/s) in the zonal wind above 250 km relative to the noninteractive simulation. A much smaller effect, characterized by an 8-hour periodicity spanning 24 hours, is seen in the meridional windcomponent.

49851 (AD-A–222574/6/XAB) **Conditional climatology of Ap: The relationship between solar flares and geomagnetic storms.** Wilson, D.L.; Edson, R.T. Air Force Environmental Technical Applications Center, Scott AFB, IL (USA). Feb 1990. 104p. (USAFETAC/TN–90/001). Source: NTIS, PC A06/MF A01.

This report documents a study of USAFETAC's optical solar flare database and its relationship to Gottingen's planetary geomagnetic index (Ap). The study was based on solar flare data with an 11-year period of record (1975 to 1986–Solar Cycle 21). After solar flares and Ap indices were studied separately, more than 27,000 flare reports were merged with 3-hour Ap values for 7 days after each flare. The resultant dataset was analyzed with respect to certain flare characteristics (such as importance, brightness, duration, solar location, and phase of the solar cycle) to find the best predictor of geomagnetic storming. The results were summarized in contingency tables (provided in Appendix B) for use as solar forecasting aids. Some flares were found to have more of an influence on the Earth's geomagnetic field than others. Of all the features studied, a flare's importance and location on the disk seemed to be best predictors of geomagnetic storming.

49852 (AD-A–222580/3/XAB) **Simultaneous relativistic-electron and auroral-particle access to the polar caps during interplanetary magnetic field Bz northward: A scenario for an open-field line source of auroral particles.** Gussenhoven, M.S.; Mullen, E.G. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 1 Dec 1989. 14p. (GL-TR–90-0139). Source: NTIS, PC A03/MF A01.

Pub. in Jnl. of Geophysical Research, Vol. 94, No. A12, 17121-17132(1 Dec 1989).

The large magnetic storm of February 1986 provides a unique opportunity to assess whether existing open-closed theories of the magnetosphere can consistently account for precipitating particle signatures measured at 840 km under a wide variety of solar wind and solar particle conditions. The simultaneous observation are prepared for relativistic electrons associated with a solar proton event and of auroral ions and electrons associated with a polar cap arc event, made across the central polar cap using detectors on board the Defense Meteorological Satellite Program (DMSP) satellites. On February 7 while a solar proton event was still in progress, polar cap arc activity (interplanetary magnetic field (IMF)B2 large and positive, Kp = 3+) occurred prior to a prolonged period of oval arc activity (IMF B2 large and negative, Kp = 6-). Throughout these periods the following are identified: the equatorward edge of the relativistic electron precipitation; the outer zone electron poleward and equatorward boundaries; the equatorward auroral electron and ion boundaries; and the auroral electron transition boundary. The history of the boundaries is presented as the transition from intense polar cap activity to intense auroral oval activity takes place. The data clearly show that the polar cap region of relativistic electron precipitation does not change significantly as the sign of B2 changes. On the other hand, the boundary layer

population, which contains auroral arcs and 1- to 10-keV ion precipitation, expands to fill most of the polar cap for B2 northward and greatly contracts as B2 turns southward. The expansion is not symmetric between poles.

49853 (AD-A-222609/0/XAB) **Viking data analysis. Final technical report, August 1986-March 1990.** Quinn, J.M. Lockheed Missiles and Space Co., Palo Alto, CA (USA). Space Sciences Lab. 25 May 1990. 59p. Contract N00014-86-C-0159. Source: NTIS, PC A04/MF A01.

The polar orbiting Swedish research satellite, Viking, obtained extensive data on auroral zone phenomena. Data from the Viking Hot Plasma Experiment have been analyzed to investigate auroral acceleration and the transport of plasma between the ionosphere and magnetosphere. A detailed statistical study was made of the relative location of ionospheric ion acceleration with respect to various magnetospheric plasma boundary signatures. The results indicate that the ion acceleration occupies a much wider latitudinal extent of the auroral zone than is expected by many current models; and that the regions of ion acceleration are ordered by, and move with, several magnetospheric plasma boundaries. Multi-spacecraft analyses of transverse ion acceleration broadband low-frequency waves have been performed and indicate that this mechanism is an important factor in transporting plasma into the magnetosphere.

49854 (AD-A-222612/4/XAB) **Development of a comprehensive magnetohydrodynamic model of solar-terrestrial interaction. Final report, 1 March 1986-30 September 1988.** Stahara, S.S. RMA Aerospace, Inc., Mountain View, CA (USA). Dec 1988. 110p. Contract F49620-86-C-0035. (RMA-TR-0103). Source: NTIS, PC A06/MF A01.

The work relates to the preliminary development of a comprehensive, multi-level, 3-D magnetohydrodynamic model that seeks to describe the detailed, global interaction of the solar wind plasma and magnetic field with the Earth's geospace. The development of five separate advanced computational submodels of the complete interaction model involves approximately 42,000 lines of fortran source code. These submodels provide the capability for quantitatively simulating a variety of steady and unsteady phenomena associated with the solar wind-terrestrial environment interaction process to a degree previously unattainable. A number of these new developments have been incorporated into a core interaction submodel that can be structured to work in both a rapid warning mode for spacecraft protection as well as in a detailed scientific analysis mode for fundamental studies. The other submodels developed either simulate similar phenomena of the solar wind-terrestrial environment interaction process as the core interaction submodel but at a higher level of simulation accuracy or simulate additional interaction phenomena.

49855 (AD-A-222861/7/XAB) **Amplitude and phase scintillation and ionospheric irregularities at sub-auroral latitudes. Interim report, 30 September 1987-31 March 1989.** Kersley, L.; Pryse, S.E.; Russell, C.D. University Coll. of Wales, Aberystwyth (UK). Dept. of Physics. 31 Mar 1989. 39p. Grant AFOSR-87-0378. Source: NTIS, PC A03/MF A01.

Intensity and phase scintillation has been studied by monitoring transmissions from NNSS satellites at Lerwick, a sub-auroral location in northern UK. Observations commenced in July 1987 and the first part of the present report concentrates on an analysis of scintillation occurrence morphology during the first ten months of the investigation. A discrete region of irregularities close to the boundary is implied from the observations while the absence of a significant geometrical enhancement about the geomagnetic field position suggests that the irregularities close to the boundary may have small axial ratios. The remainder of the report is concerned with a comparative study of the scintillation boundary for irregularities of sub-kilometer scale and the boundary of <30 m scale irregularities causing auroral backscatter of HF radar signals. In general the scintillation boundary was found to be some 7 to 8 deg polewards of that detected by the radar. In a reanalysis of the data a reconciliation could be made to get agreement in only about half of cases studied.

49856 (AD-A-222944/1/XAB) **Neutral and ion composition changes in the F Region over Millstone Hill during the equinox transition study.** Oliver, W.L. Boston Univ., MA (USA). 1 Apr 1990. 8p. Contract F49620-88-C-0111. Source: NTIS, PC A02/MF A01.

Pub. in Jnl. of Geophysical Research, Vol. 95, No. A4, 4129-4134(1 Apr 1990).

Overhead ionospheric incoherent scatter radar data from Millstone Hill is used to deduce the storm time variations of the thermospheric temperature, O and N2 densities, and F1 region ion composition during the Equinox Transition study of September 17-24, 1984. The measured neutral temperature profile and O density at 400 km altitude is extrapolated to determine O density changes in the lower thermosphere. Using these O densities and the measured electron densities, we deduce the variation of the N_2 density. Our initial attempt leads to the deduction of large depletions in both O and N_2 in the lower thermosphere. The radar-measured neutral temperatures were contaminated by ion-neutral frictional heating effects during the disturbed periods of the ETS and this served to invalidate neutral density extrapolations made with these temperatures. The height of 50% O+ ion composition in the F1 region and the height of the peak electron density in the ionosphere, are completed and compared. The height of the peak on the distributed days was located in the lower F1 region molecular-ion layer rather than in the F1 region O+ layer. This occurrance has serious consequences for methods of deducing neutral winds from the height of the F layer, for these methods rely on the peak containing primarily O+ ions.

49857 (AD-A-223198/3/XAB) **Pi 2 pulsations and the substorm current wedge: Low-latitude polarization.** Lester, M.; Singer, H.J.; Smits, D.P.; Hughes, W.J. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 1 Dec 1989. 11p. (GL-TR-90-0144). Source: NTIS, PC A03/MF A01.

Pub. in Jnl. of Geophysical Research, Vol. 94, No. A12, 17,133-17,141(1 Dec 1989).

Mid-latitude observations of substorm-related Pi 2 waves have established a pattern in the orientation of the major axis of the polarization ellipse relative to the substorm current wedge. The purpose of this paper relate to the mid-latitude observations to those at lower latitudes. Pi 2 wave polarization parameters (ellipticity, sense of polarization, and the orientation of the major axis, or azimuth, of the horizontal wave ellipse) were measured at the two southern stations of the AFGL Magnetometer Network located at 40 deg N magnetic latitude. For the same events the H and D component bays at the five northern stations of the AFGL network located at 55 deg N were used to locate the position of the substorm current wedge. Then the ellipticity and the azimuth of the waves were examined with respect to the current wedge. Inside the current wedge the longitudinal pattern of the polarization azimuth of the low-latitude (40 deg N) stations agrees with the observed mid-latitude (55 deg N) azimuth pattern without exception. However, outside the wedge near the longitudes of the field-aligned currents, the azimuth does not change at low latitudes as it does at 55 deg N. The difference between the mid- and low-latitude observations can be partially explained by the additional observation of positive H component bays at the low-latitude stations, which suggests that the ground-based signature of the current wedge increases in longitudinal extent with decreasing latitude. With regard to sense of polarization, inside and east of the wedge the sense is predominantly counterclockwise, just as it is at mid latitudes.

49858 (AD-A-223229/6/XAB) **Electrodynamics of the high-latitude ionosphere. Final report, September 1986-September 1989.** Heelis, R.A. Texas Univ., Richardson, TX (USA). Center for Space Sciences. Feb 1990. 33p. Contract F19628-86-K-0042. Source: NTIS, PC A03/MF A01.

Both large and small scale structure in the plasma density and velocity are important phenomena to be understood in the ionosphere. The ability to characterize the high-latitude plasma motion over large spatial scales is demonstrated here with the development of a model that can be driven by data inputs. The model can also be used to study the mechanisms producing large scale structures in the plasma. The applicability of the model is demonstrated for periods when the interplanetary magnetic field has a southward component. During periods of northward IMF the electrodynamics of the ionosphere on spatial scales of 100 km must be understood. Here the combination of ground based and space based data are

invaluable tools. We show that mesoscale features may be coherent over many hours and constitute an important signature of the interaction of the Earth's magnetic field with the interplanetary medium.

49859 (PB–90-252404/XAB) **Distribution of the daily $F0F_2$ about the monthly median.** Sowers, M.W.; PoKempner, M. Department of Commerce, Boulder, CO (USA). Inst. for Telecommunication Sciences. May 1990. 192p. (NTIA–90-263). Source: NTIS, PC A09/MF A01.

Data from 21 ionospheric sounding stations in the northern and southern hemispheres were used to characterize the day-to-day variation in the critical frequency of the F2 layer of the ionosphere. Variability in the critical frequencies are analyzed monthly and diurnally for quiet magnetic conditions during both low and high solar periods. In addition, variations in the F2 layer critical frequency are presented for active magnetic conditions during equinox periods. Tables of variabilities for each ten degree increment in magnetic latitude are also provided in the report. The dependence of variations in the critical frequency with the solar cycle index IG12 is also discussed.

6403 Atomic, Molecular, and Chemical Physics

Refer also to citation(s) 48899, 48900, 48986, 48999, 49000, 49046, 49047, 49048, 49049, 49050, 49135, 49136, 49138, 49139, 49141, 49142, 49145, 49155, 49902, 49916, 50226, 50227, 50228, 50229, 50230, 50231, 50233

49860 (CBPF-MO–001/89, pp. 9-36) **Real and complex scaling methods in atoms and molecules.** Garcia-Sucre, M. (Instituto Venezolano de Investigaciones Cientificas, Caracas (Venezuela)). Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1988. (In Spanish). (CONF-8809499–: 6. Latin American School on Theoretical Chemistry, Rio de Janeiro (Brazil), 11-17 Sep 1988). In *6. Latin American School on Theoretical Chemistry. v. 1.* Source: Available from the Library of the Comissao Nacional de Energia Nuclear, RJ, Brazil.

A revision of the method of molecular parameter scaling is made. Detailed discussion on the scaling of the nuclear and electron charges, the nuclear and electron masses and the real and complex scaling of the coordinates is performed. (A.C.A.S.).

49861 (CBPF-MO–001/89, pp. 61-85) **Bonding and interaction of molecules with surfaces.** Ellis, D.E. (Northwestern Univ., Evanston, IL (USA)). Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1988. (CONF-8809499–: 6. Latin American School on Theoretical Chemistry, Rio de Janeiro (Brazil), 11-17 Sep 1988). In *6. Latin American School on Theoretical Chemistry. v. 1.* Source: Available from the Library of the Comissao Nacional de Energia Nuclear, RJ, Brazil.

In this lecture it is intended to discuss some general features of bonding and interaction of molecules with surfaces. The geometry of surface complexes is sufficiently difficult and the interaction mechanisms are sufficiently subtle. That all possible theoretical models need to be exploited such as: (i) Semiempirical - including Huckel molecular orbital theory; (ii) first principles including self-consistent-field Hartree-Fock and Local Density approaches; (iii) explicitly correlated, including C.I., Generalized Valence Bond, Coupled Cluster Perturbation Theory and Many Body Perturbation Theory. (A.C.A.S.).

49862 (CBPF-MO–001/89, pp. 193-197) **Hartree-Fock integral method.** Trsic, M. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Dept. de Quimica e Fisica Molecular). Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1988. (In Portuguese). (CONF-8809499–: 6. Latin American School on Theoretical Chemistry, Rio de Janeiro (Brazil), 11-17 Sep 1988). In *6. Latin American School on Theoretical Chemistry. v. 1.* Source: Available from the Library of the Comissao Nacional de Energia Nuclear, RJ, Brazil.

The integral Hartree-Fock method is discussed and, as a first application, universal atomic bases are generated. STO and GTO universal bases were obtained for H to Ar(14) and more recently to Xe(15). (A.C.A.S.).

49863 (CBPF-MO–001/89, pp. 161-192) **Refining of crystal structures of macromolecules with molecular dynamics.** Mascarenhas, Y.P. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1988. (In Portuguese). (CONF-8809499–: 6. Latin American School on Theoretical Chemistry, Rio de Janeiro (Brazil), 11-17 Sep 1988). In *6. Latin American School on Theoretical Chemistry. v. 1.* Source: Available from the Library of the Comissao Nacional de Energia Nuclear, RJ, Brazil.

In this work, the refining of crystal structures of macromolecules is discussed. The annealing method is employed and it can be previewed that, this method, will be largely used in the future for protein crystallography. (A.C.A.S.).

49864 (CBPF-MO–001/89, pp. 203-227) **Relativistic correction of the energy atomic levels.** Parera Lopez, J.J. (Universidad de Oriente, Santiago de Cuba (Cuba). Dept. de Fisica General y Teorica). Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1988. (In Spanish). (CONF-8809499–: 6. Latin American School on Theoretical Chemistry, Rio de Janeiro (Brazil), 11-17 Sep 1988). In *6. Latin American School on Theoretical Chemistry. v. 1.* Source: Available from the Library of the Comissao Nacional de Energia Nuclear, RJ, Brazil.

In this work, relativistic correction for the energy atomic levels is discussed. Many considerations are taken into account such as: Dirac, Breit and Bethe-Salpeter equations, Hartree-Fock-Dirac approximation, secular equation for the correction of levels and many others. (A.C.A.S.).

49865 (CBPF-MO–001/89, pp. 279-294) **Sobre experimental aspects of electron correlation in molecules.** Bonham, R.A. (Sao Carlos Univ., SP (Brazil). Dept. de Quimica); Barbieri, R.S. Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1988. (CONF-8809499–: 6. Latin American School on Theoretical Chemistry, Rio de Janeiro (Brazil), 11-17 Sep 1988). In *6. Latin American School on Theoretical Chemistry. v. 1.* Source: Available from the Library of the Comissao Nacional de Energia Nuclear, RJ, Brazil.

Electron impact spectroscopy at high energy, has been used to obtain the absolute generalized oscillator strength (GOS) for N_2 as a function of momentum transfer. Some rules of the GOS were employed to obtain the X-ray incoherent scattering factor, S(K) as a function of K. Comparison of the experiments with the results of a near Hartree-Fock molecular wave function calculation of S(K) revealed the effect of electron correlation on the compared quantity. (A.C.A.S.).

49866 (CEA-CONF–10028) **Vacancies in BCC solid ^{3}He.** Bernier, M.E.R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Service de Physique du Solide et de Resonance Magnetique); Hetherington, J.H. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique du Solide et de Resonance Magnetique. 1989. 2p. (CONF-8904257–: Quantum fluids and solids, Gainesville, FL (USA), 24-28 Apr 1989). Order Number DE91700516. Source: NTIS (US Sales Only), PC A02/MF A01.

Short communication. HELIUM 3/vacancies; VACANCIES; QUANTUM FLUIDS; BCC LATTICES

49867 (CEA-CONF–10029) **Low temperature susceptibility of large molar volume bcc solid ^{3}He.** Bernier, M.E.R.; Bassou, M.; Chapellier, M.; Rotter, M. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique du Solide et de Resonance Magnetique. 1989. 2p. (CONF-8904257–: Quantum fluids and solids, Gainesville, FL (USA), 24-28 Apr 1989). Order Number DE91700515. Source: NTIS (US Sales Only), PC A02/MF A01.

Short communication. HELIUM 3/magnetic susceptibility; BCC LATTICES; QUANTUM FLUIDS; ULTRALOW TEMPERATURE

49868 **The physics of electronic and atomic collisions.** AIP Conference Proceedings 205. Dalgarno, A. (Harvard-Smithsonian Center for Astrophysics, Cambridge, MA (USA)); Freund, R.S.; Koch, P.M.; Lubell, M.S. 680p. American Institute of Physics, New York, NY (US) ([1990]). Sponsored by U.S. DOE Energy Research.

From 16. international conference on the physics of electronic and atomic collisions; New York, NY (USA); 25 Jul - 1 aug 1989.

This report contains papers on electron, photon, ion, atom, and molecules collisions. Also included are papers from the following symposiums: correlated transfer/excitation and autoionization; collisions with cold particles; collisions involving positrons; and supercomputational collision physics. (LSP)

49869 (CONF-900802–7) **The transuranium elements: Members of the 5f series.** Gruen, D.M. Argonne National Lab., IL (USA). [1990]. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 200. American Chemical Society national meeting; Washington, DC (USA); 26-31 Aug 1990. Order Number DE90017680. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the last 40 years, the electronic structure of the actinide elements has been investigated in great detail primarily by means of spectroscopic studies of gaseous atoms and ions, as well as of solutions and compounds, and by magnetic susceptibility and electron spin resonance studies of metals, alloys, and compounds. Both experimental and theoretical studies have resulted in accurate values for spin orbit coupling and crystal field parameters for 5f electrons, for example, which can be compared with values characteristic of 4f electrons. The somewhat greater spatial extent of 5f versus 4f wavefunctions gives rise to 5f orbital participation in the bonding of actinide element organometallic compounds and leads to an extensive and intricate organometallic chemistry for this group of elements. This report reviews the history of the development of ideas concerning the electronic structure of the new elements which, by determining their chemistry, would fix their position in the Periodic Table.

49870 (CONF-900964–2) **Applications of diode lasers to resonance ionization mass spectrometry.** Young, J.P.; Shaw, R.W.; Smith, D.H. Oak Ridge National Lab., TN (USA). [1990]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 5. international symposium on resonance ionization spectroscopy and its applications; Ispra (Italy); 16-21 Sep 1990. Order Number DE90017768. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Diode lasers have been utilized in resonance ionization mass spectrometry (RIMS). These devices have been used to excite the first transition of several 1 + 1 + 1 multiple photon processes for both lanthanum 138 and 139. Enhanced isotopic selectivity resulted. Very-high resolution spectra were also obtained with the diode laser step to yield new atomic hyperfine structure constants for several levels of lanthanum. An isotopically selective RIMS instrument can be envisioned that used only diode lasers for optical excitation followed by a non-optical ionization step. 8 refs., 4 figs.

49871 (CONF-9009174–3) **Large collective lamb shifts in high pressure noble gases.** Payne, M.G.; Garrett, W.R.; Hart, R.C.; Datskou, I.; Wray, J. Oak Ridge National Lab., TN (USA). [1990]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 5. international symposium on resonance ionization spectroscopy and its applications; Varese (Italy); 16-21 Sep 1990. Order Number DE90017761. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

When three-photon atomic excitation is produced by two laser beams of angular frequencies ω_{L1} and ω_{L2}, which are crossed at an angle θ, large cooperative pressure dependent shifts can be produced in the peak position of the excitation lineshape. By studying an experimental situation in xenon the theoretical predictions are shown to be in precise agreement with experiment for several angles and a wide range of pressures. The possibility of observing related shifts in nonlinear processes (such as backward stimulated hyper-Raman generation) is discussed. 14 refs., 2 figs.

49872 (CONF-9009174–4) **Collisional and electric-field ionization of laser-prepared Rydberg states in an ion trap mass spectrometer.** Ramsey, J.M.; Whitten, W.B.; Goeringer, D.E.; Buckley, B.T. Oak Ridge National Lab., TN (USA). [1990]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 5. international symposium on resonance ionization spectroscopy and its applications; Varese (Italy); 16-21 Sep 1990. Order Number DE91000557. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Rydberg states of rubidium are selectively generated by one and two photon laser excitation in a quadrupole ion trap mass spectrometer. Collisional and electric-field ionization is investigated in trapping device. CCl_4 is studied as a target for ionization of Rydberg states through electron attachment.

49873 (DOE/ER/13491–450) **[Atomic physics with highly charged ions]: Progress report, FY 1990.** Richard, P. Kansas State Univ., Manhattan, KS (USA). [1990]. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER13491. Order Number DE90017775. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper discusses the research being performed with highly charged ion collisions at J. R. Macdonald Laboratory. (LSP)

49874 (DOE/ER/13958–16) **Semiempirical studies of atomic structure: Progress report, July 1, 1990–June 30, 1991.** Curtis, L.J. Toledo Univ., OH (USA). Dept. of Physics and Astronomy. 1 Sep 1990. 30p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER13958. Order Number DE90017653. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper deals with the following topics: Review of Highly Ionized Atoms; Parametrized Systematizations of Spectroscopic Data; Transition Probability Computations; and Beam-foil Measurements.

49875 (IAE–4754-6) **Dissociative recombination of molecular ions H_2^+.** Abarenov, A.V.; Marchenko, V.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 13p. (In Russian). Order Number DE91600608. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The total cross sections of dissociation and dissociative recombination of slow electrons and molecular ions H_2^+ have been calculated in terms of the quasiclassical and dipole approximations. In the calculations allowance was made for the quantum nature of vibrational motion of heavy particles and presence of autoionization of divergence states of the $H_2(\Sigma_u, nl)$ molecules. It is shown that the H_2^+ ion dissociation cross sections are dominant in increase of the electron energy in the $\epsilon >$or approx. 2-3 eV region for $H_2^+(v)$ ion distribution over the vibrational levels characteristic for the beam experiments. 15 refs.; 5 figs.

49876 (IPPCZ–293/III, pp. 74-84) **A 40 keV neutral lithium beam source for tokamak CASTOR.** Zacek, F. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu); Stoeckel, J.; Jakubka, K.; Badalec, J.; Valovic, M.; Kolacek, K. Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. (CONF-8903244–: Seminar of CMEA experts on plasma diagnostics in T-15 tokamak, Liblice (Czechoslovakia), 15-16 Mar 1989). In *Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak".* Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

A high-energy lithium atom source was developed at the IPP, Prague for active corpuscular diagnostics of the plasma in the Castor tokamak. The solid ion emitter, the extracting electrode system, the accelerating system, and the lithium beam neutralizer are described in detail. Results of experimental tests of the apparatus are reported. The emitter emission can reach a few hundreds of μA, the neutralizer efficiency being close to unity for the beam energy in the range of 5 to 20 keV. The maximum beam energy is 40 keV, its minimum diameter at a distance of 1 m from the gun is 10 to 15 mm. (J.U.).

49877 (JINR–2-35-89, pp. 15-20) **Relativistic corrections to energy levels of weakly bound states of mesic molecules ddμ and dtμ.** Bakalov, D.D.; Korobov, V.I. Joint Inst. for Nuclear Research, Dubna (USSR); Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation. 1989. (In Russian). In *JINR rapid communications: Collection.* Order Number DE90706214. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

Relativistic shift and hyperfine splitting of the energy levels have been calculated with the account of the electromagnetic structure of the nuclei for weakly bound states (J=v=1) of mesic molecules

$dd\mu$ and $dt\mu$. There were used the obtained by variational method approximate wave functions which reproduce exact nonrelativistic energy level with no more error than 0.5 MeV. The performed results are necessary for the investigation of the mesic molecule formation processes arised in muon catalyzed fusion. 10 refs.; 4 tabs.

49878 (KEK–89-19, pp. 34-42) **Direct observation of hydrogen wave functions.** Ikeda, Susumu (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Dec 1989. (CONF-8911202–: 2. workshop of Japan-UK collaboration on neutron scattering research, Tsukuba (Japan), 1 Nov 1989). In *Proceedings of the second workshop of Japan-UK collaboration on neutron scattering research.* Order Number DE90798861. Source: NTIS (US Sales Only), PC A07/MF A01.

The aim of this work is to observe the momentum transfer dependence of local vibrational mode intensities in metal hydrides, and to directly derive the hydrogen wave functions. In the case where the excitation energy is much greater than kT without any contribution of the host metal vibration, the inelastic neutron scattering intensity of the local modes of a powder sample, I(Q), is given by the transition probability from the initial state to the final state. The equation derived for I(Q) indicates that I(Q) is explicitly expressed in terms of the wave functions of the hydrogen. Therefore, measurements of I(Q) can provide the possibility of a direct investigation of the wave functions. At the beginning stage of the present approach, it is revealed that the momentum transfer dependence of the local modes observed by the neutron scattering spectrometer can be completely described by the above-mentioned equation. Investigation clearly shows that the wave functions for the first, second and third excited states in ZrH_2 are perfectly harmonic, and strongly suggests that the wave function can be directly examined based on measurements of I(Q). (N.K.).

49879 (KFTI–88-22) **Influence of the Ore slot on the positron energy distribution function.** Bolotov, V.N.; Novikov, V.E.; Tur, A.V.; Yanovskij, V.V. AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst. 1988. 6p. (In Russian). Order Number DE91600611. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

On the basis of Bolzmann kinetic equation a theory of positron subsystems in gases with positron sources and run off in energy space is developed. Nonequilibrium stationary function of positron distribution in gases which permits to calculate probability of positronium production in gases is derived. 5 refs.

49880 (LBL–26455, pp. 128) **Monte Carlo study of electron correlation functions for small molecules.** Sun, Z.; Reynolds, P.J.; Owen, R.K.; Lester, W.A. Jr. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A study is made of electron-electron correlation functions for use in trial wave functions for small molecules. New forms are proposed that have only a few variational parameters, and these parameters have physical meanings that are easily discerned. Total energies for H_2, LiH, and Li_2 computed using these correlation functions are presented, and comparison is made with previous forms, including the Jastrow-Pade form often used in Monte Carlo studies. The authors further treat the possibility that correlation depends not only on the separation of a pair of electrons but also on the location of the electron pair relative to the nuclei - indicative of a density-dependent or many-body correlation effect. Their results indicate that such a many-body correlation effect is weakly present.

49881 (LBL–26455, pp. 128) **Electronic structure, hyperfine interactions, and magnetic properties for iron octahedral sulfides.** Braga, M.; Lie, S.K.; Taft, C.A.; Lester, W.A. Jr. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Spin-polarized multiple-scattering calculations have been performed for FeS_6^{n-} (n = 8, 9, 10) clusters in order to study the electronic structure of the iron atom octahedrally coordinated to sulfur. The calculated total spin and charge densities together with the 3d and 4s atomic populations are used to interpret the Moessbauer hyperfine parameters. A detailed discussion of the hyperfine interaction and magnetic properties is given for the spinel greigite (Fe_3S_4). Possible existence of a Fe(IV) state in minerals containing only FeS is discussed, and it is concluded that it is highly unlikely.

49882 (LBL–26455, pp. 142-143) **Dynamics of endoergic substitution reactions: I. Br + chlorinated aromatic compounds.** Robinson, G.N.; Continetti, R.E.; Lee, Y.T. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The endoergic substitution reactions Br + R-Cl → Cl + R-Br (R = o-, m-, and p-$CH_3C_6H_4$, C_6H_5, C_6F_5; $\Delta H^\circ \simeq 15$ kcal/mol) have been studied using the crossed-molecular-beams method in the collision energy (E_c) range 20-35 kcal/mol. The $CH_3C_6H_4Br$ and C_6F_5Br products were found to be mostly forward scattered with respect to the incident Br beam, indicating that the lifetimes of the Br-R-Cl collision complexes are short compared to their rotational periods. The product translational-energy distributions and excitation functions for these reactions are well reproduced by statistical calculations that assume only a few vibrational modes in the collision complexes particulate in intramolecular energy redistribution prior to Cl elimination. Ring substituents are found to affect both the extent of energy redistribution in the complexes and the probability of Br addition. For example, no substitution product was observed with m-$CH_3C_6H_4Cl$ or C_6H_5Cl. The relative magnitudes of the cross sections are explained in terms of possible features of the potential-energy surfaces along their reaction coordinates.

49883 (LBL–26455, pp. 143) **Dynamics of endoergic substitution reactions. II. Br + (CH_2CCl_2) → Cl + (CH_2CClBr).** Robinson, G.N.; Continetti, R.E.; Lee, Y.T. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The authors have extended crossed-beams studies to the reactions of Br atoms with 1,1- and trans-dichloroethylene. The slopes of the product translational-energy distributions and excitation functions for both reactions support their previous conclusion that Cl elimination from Br-R-Cl collision complexes can compete with Br elimination only in the limit that few vibrational modes of the complex are active in energy redistribution. The substitution cross section for the Br + CH_2CCl_2 reaction is considerably lower than that for the Br + trans-CHClCHCl reaction in the collision-energy range 15-25 kcal/mol, suggesting that steric effects play a dominant role in determining the relative magnitudes of the cross sections.

49884 (LBL–26455, pp. 143) **Crossed-molecular-beam studies of the reactions of methyl radicals with iodoalkanes.** Robinson, G.N.; Nathanson, G.A.; Continetti, R.E.; Lee, Y.T. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The I-atom exchange reactions, $CH_3RI \rightarrow CH_3I + R$ [R = CF_3, $(CH_3)_3C$], were investigated at a collision energy of ≈ 13 kcal/mol using the crossed-molecular-beams technique. The supersonic beam of methyl radicals was formed by pyrolyzing a mixture of ≈ 1% di-tert-butyl peroxide in helium in a quartz nozzle. A large fraction of the total energy available to the products from these reactions is channeled into relative translation [≈ 50% for R = $(CH_3)_3C$ and ≈ 70% for R = CF_3], suggesting that the dominant interaction among the products is repulsive. The CH_3I product from both reactions was observed to be entirely backward scattered with respect to the incident radical beam, indicating that a roughly collinear C-I-C transition-state geometry is favored. The present results are compared to those of earlier crossed-beam studies of the $CH_3 + IY \rightarrow CH_3I + Y$(Y = Cl, Br, I) reactions; the differences observed among these reactions are explained with reference to the CH_3I-Y and CH_3I-R interaction potentials.

49885 (LBL–26455, pp. 143) **Polarization effects in reactive scattering of Na atoms in the 4D level.** Weiss, P.S.; Covinsky, M.H.; Schmidt, H.; Balko, B.A.; Lee, Y.T.; Mestdagh, J.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and*

Chemical Sciences Division annual report, 1988. Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Experiments performed using a crossed-beam apparatus have shown that the reactivity of Na(4D) with HCl and O_2 changes substantially as the 4d orbital alignment is varied. This change is different for the two reactions. The favorable alignment for the reaction with HCl has the d orbital aligned along the relative-velocity vector of the reactants. This result is consistent with a long-range electron transfer initiating the reaction and suggests that the Na-Cl axis dominates over the H-Cl axis in determining the favorable atomic orbital alignment. For the reaction with O_{d2}, the NaO formation has a high translational-energy threshold, and the favored orbital alignment varies as a function of the NaO laboratory scattering angle. Very restricted conditions are found to be necessary for the reaction: near-collinear geometry and the d orbital perpendicular to the molecular axis.

49886 (LBL–26455, pp. 143-144) **Ultrahigh-resolution (1+1) photoionization spectroscopy of KrI: Hyperfine structures, isotope shifts, and lifetimes for the n = 5,6,7 4^5ns Rydberg levels.** Trickl, T.; Vrakking, M.J.J.; Cromwell, E.; Lee, Y.T.; Kung, A.H. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

High-resolution measurements of the hyperfine structures and isotope shifts are reported for KrI n = 5,6,7 $4p^5$ns Rydberg levels, obtained using a soft x-ray and extreme ultraviolet (XUV) laser with a bandwidth of 210 MHz in a resonant two-photon-ionization scheme. Use of known I_2 frequencies yields an improved absolute calibration of the Kr energy levels by more than one order of magnitude. The nuclear-quadrupole hyperfine structure indicates that the $4p^56s$ and $4p^57s$ states are described by a pure jj-coupling scheme, whereas the $4p^55s$ states depart from a pure jj-coupling scheme by 0.37(6) %. The magnetic hyperfine structures shows that the $4p^5$ns states are mixed with $4p^5$n'd states. The isotope shifts can be described as pure mass effects within the precision of their experiment. For the $4p^56s$ and $4p^57s$ states, lifetimes were determined that differ markedly from theoretical literature values.

49887 (LBL–26455, pp. 147) **High-energy atomic physics.** Gould, H. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The goal of this program is to understand atomic collisions of relativistic ions and to test quantum electrodynamics (QED) in very high atomic-number atoms. These are new areas of research that involve physics that is not accessible at lower energies or with ions of lower atomic number. This research is conducted at the Lawrence Berkeley Laboratory's Bevalac, the world's only relativistic heavy-ion accelerator. Recent results include the first measurement of electron-impact ionization of highly ionized very heavy ions (U^{88+}, U^{89+}, U^{90+}, and U^{91+}). This measurement was done by channeling relativistic uranium ions through Si single crystals. These and earlier experiments in this program have led to an understanding of relativistic heavy-ion-atom collisions, which in most cases is now more complete than for nonrelativistic collisions. Present activities include a precision (0.1%) measurement of the Lamb shift in uranium. Future experiments will attempt to observe a new capture mechanism - electron capture from the production of electron-positron pairs by the motion Coulomb fields of relativistic nuclei passing within atomic distances of each other.

49888 (LBL–26455, pp. 149) **Atomic physics.** Prior, M.H. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

This program conducts experimental studies of atomic structure and collisional interactions in atomic systems or projectile-target combinations that have unique properties. At present, emphasis is on the study of highly charged ions, their energy-level structure, and their behavior in low-energy collisions with atomic targets. Among the broad range of possible research topics, those are selected that are best addressed by the unique facilities and expertise at LBL and that have impact as strong tests of atomic of collision theory. Often, topics studied have relevance to plasma diagnostics in tokamak devices, or to advanced laser technology. Collaborative efforts with investigators from outside LBL form a part of this program activity when they are consistent with research goals. Presently, efforts are under way that yield metastable energy-level structures of highly charged ions, reveal details of multiple electron-transfer processes, and reveal Auger electron and x-ray emission spectra from ion-atom collisions.

49889 (LBL–26455, pp. 149-150) **Double and single electron capture in slow collisions of $Ar^{9,8+}$ ions with He atoms.** Hutton, R.; Prior, M.H.; Chantrenne, S.; Chen, M.H.; Schneider, D. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The process of double electron capture in a single collision between a slow, highly charged ion and an atomic target is the subject of a great deal of current interest, both theoretically and experimentally. This work report experimental studies with F-like (9-electron) Ar^{9+} ions, which provide evidence of a double-capture process similar to those observed with He-like projectiles. These experiments were performed using ion beams produced by the LBL electron cyclotron resonance (ECR) ion source and the associated atomic physics beamline facilities. The method uses the technique of zero-degree (forward direction) electron spectroscopy, incorporating two electron spectrometers in tandem. In this work they observed Auger lines using both Ar^{8+} and Ar^{9+} projectiles. Ar^{8+} is a Ne-like ion with a $2p^6\ ^1S_0$ ground state, and neither single nor double electron capture has much probability, at these collision energies, of producing states with Auger decay channels. Ar^{9+} is F-like (9 electrons) with a $2p^5\ ^2P$ ground configuration; single electron capture will produce a Ne-like singly excited system and consequently no auger electrons. Two-electron capture can produce Na-like core-excited states with configurations of the form $2p^5nln'l'\ ^2L$ and ^4L.

49890 (LBL–26455, pp. 150-151) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The study of Auger electron spectra from Na-like highly charged ions excited by double-electron-capture collisions is systematically being extended using F-like ion beams ranging from Si^{5+} to Cu^{20+}. This will yield an isoelectronic comparison of production and spectral features useful in understanding the role of dynamic correlation, possible spin reorientation in double-capture processes, and metastable level energies. To gain further insight into the correlated double-capture process, an experiment has been mounted to measure electron spectra in coincidence with the projectile final charge state, to determine the extent of capture into the super nonequivalent states consisting of one electron in a bound state of the projectile and one in the continuum moving with the projectile. Preliminary observations indicate that nearly all the electrons captured to the continuum of the projectile (that is, unbound, but nearly at rest in the projectile frame) are associated with a projectile final charge state reduced by one unit. A detailed study of the scattering of Ne^{9+} (H-like) projectiles from Ne atoms, which identifies the final charge state of the target and projectile, is undergoing final analysis. This study shows details of the multielectron transfer process in slow (90 keV), highly charged ion-atom collisions, and reveals oscillatory structure in the scattering probability vs angle (or impact parameter) for certain final-charge-state combinations.

49891 (PB–90-244591/XAB) **Updated excitation and ionization cross sections for electron impact on atomic oxygen. Quarterly report.** Laher, R.P.; Gilmore, F.R. R and D Associates, Marina del Rey, CA (USA). ©1990. 29p. Contract DNA-001-85-C-0022. Source: NTIS(Order as PB90-244526).

Included in Jnl. of Physical and Chemical Reference Data, Vol. 19, No. 1, 277-304(1990). Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Cross sections for the excitation and ionization of atomic oxygen by electron impact are presented as the result of a critical review of experimental and theoretical work on this subject. An effort has been made to compile the most accurate and complete set of cross sections available. More than 60 profiles of excitation cross section versus electron-impact energy are presented. These include transitions to the forbidden metastable O(2p(4) singlet D) and O(2p(4)

singlet s) states, the allowed autoionizing O(2p(5) triplet p(0)) state, nine allowed Rydberg series, and twenty-nine forbidden Rydberg series. Recommended ionization cross sections for transitions to the various outer-electron ionization states to the inner-electron ionization state O(1+) quartet p, and to the O(2+) state are also given. The data presented in the report will be useful in calculations of aeronomical and artificially-induced electron impact on atomic oxygen, an important component of the upper atmosphere.

49892 (SAND–90-1676C) **Light-heavy-hole-mixing-induced selection rules for magneto-luminescence and valence-band energy dispersion in semiconductor quantum wells.** Lyo, S.K.; Jones, E.D. Sandia National Labs., Albuquerque, NM (USA). [1990]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901105–6: Fall meeting of the Materials Research Society, Boston, MA (USA), 26 Nov - 1 dec 1990). Order Number DE90015989. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The validity of the semiclassical approximation for the valence band structure of a QW (quantum well) was studied in a perpendicular magnetic field. The relative oscillator strengths of the main and forbidden transitions for magneto-luminescence were calculated for n-type quantum wells. 6 refs., 3 figs.

49893 (SAND–90-2317C) **Stochastic electron beams in the ion-focused regime.** O'Brien, K.J.; Freeman, J.R. Sandia National Labs., Albuquerque, NM (USA). [1990]. 3p. Sponsored by U.S. Department of Defense. DOE Contract AC04-76DP00789. (CONF-9009200–9: 1990 LINAC conference, Albuquerque, NM (USA), 10-14 Sep 1990). Order Number DE90017033. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The ion-hose instability can catastrophically disrupt a classical electron beam propagating in the ion-focussed regime (IFR). Ion hose is driven by a resonant interaction between the smooth electron-betatron and ion-betatron orbits. In a classical beam phase correlations decay secularly in time $c(t)/c(t_0) \sim (t_0/t)^n$ $(0 < n < 2)$. In a stochastic electron beam the electron orbits are chaotic. Such a beam can be immune to resonant instabilities because phase correlations decay exponentially fast $c(t)/c(0) \sim e^{-ht}$ thus destroying the coherence of the electron response on the growth time $1/\gamma_g$ if $h \sim \gamma_g$. Using the same principles we can also envision a stochastic damping cell in which electron phase correlations damp exponentially $c(z)/c(0) \sim e^{-hz}$ thus centering and conditioning a beam more effectively than a classical phase-mixing cell in which $c(z)/c(z_0) \sim (z_0/z)^n$. A "triple-Bennett" IFR system and the analogous "triple-wire" damping cell are analyzed. The K-entrophy is introduced as a figure-of-merit for such stochastic electron beam systems. 16 refs., 7 figs.

49894 (TRI-PP–90-22) **Capture and transfer of pions in hydrogenous materials.** Armstrong, D.S. (Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA)). British Columbia Univ., Vancouver, BC (Canada). TRIUMF Facility. May 1990. 19p. (CONF-9005273–1: International workshop on exotic atoms in condensed matter, Erice (Italy), 19-25 May 1990). Order Number DE90017756. Source: NTIS (US Sales Only), PC A02/MF A01 - OSTI.

Pionic hydrogen is a short-lived exotic hydrogen isotope in which a negative pion replaces the atomic electron. The formation and subsequent interactions of pionic hydrogen are discussed, with emphasis on the process of pion transfer. Recent results using the pion charge-exchange reaction (π^{minus},π^0) obtained at TRIUMF are reviewed. 35 refs., 9 figs., 3 tabs.

49895 (UCRL-JC–104665) **Atomic physics of highly charged ions in an electron beam ion trap.** Marrs, R.E. Lawrence Livermore National Lab., CA (USA). Jul 1990. 15p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-900716–1: 12. international conference on atomic physics, Ann Arbor, MI (USA), 30 Jul - 3 aug 1990). Order Number DE90017528. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Two electron beam ion traps are in use at LLNL for the purpose of studying the properties of very highly charged ions and their interactions with electrons. This paper reviews the operation of the traps and discusses recent experiments in three areas: precision transition energy measurements in the limit of very high ion charge, dielectronic recombination measurements for the He-like isoelectronic sequence, and measurements of x-ray polarization. 22 refs., 11 figs., 1 tab.

6404 Fluid Physics

Refer also to citation(s) 49154, 49740

49896 (DOE/OR/00033–T444) **Magnetohydrodynamic modification of the TEACH-T code and the prediction of the maximum azimuthal velocity in a conducting fluid.** Willis, M.G. Pennsylvania State Univ., University Park, PA (USA). Graduate School. Dec 1989. 80p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-76OR00033. Order Number DE90017510. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

An extension of the two dimensional turbulent fluid dynamics code, TEACH, is developed. This extension incorporates a third (azimuthal) velocity component, with azimuthal symmetry assumed. Also included is the ability to solve for an electrostatic potential field with given boundary conditions. This electrostatic potential yields an electric field which, when coupled with the included constant magnetic field, produces Lorentz forces. These are accounted for as body forces in the appropriate components of the Navier-Stokes' momentum equation. The extensions in the code are compared with analytic results where possible and are found to be highly accurate. Finally, a semi-empirical correlation is developed to predict the magnitude and position of the maximum value of the added velocity component give the magnetic field strength and the value of the potential difference between an assumed central electrode and grounded outer shell. The correlation is seen to give excellent results for a wide range of electrostatic potential boundary conditions and magnetic field strengths acting on the working fluid sodium.

49897 (IAE–4833-2) **Vacuum polarization of electromagnetic field and electrodynamic processes on nucleus.** Tkalya, E.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 19p. (In Russian). Order Number DE91601023. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The influence of vacuum polarization of electromagnetic field caused by conducting boundaries on electrodynamic processes, described by two-order diagrams with virtual photon-internal electronic conversion, inelastic electron scattering and others - was analysed. It was found that the probability of such processes could be changed significantly. It is suggested that this phenomenon can be used for creation of inversion population in Moessbauer transition and for investigation metal surfaces. 29 refs.; 7 figs.

49898 (LA-UR–90-2638) **Transport, mixing and stretching in a chaotic Stokes flow: The two-roll mill.** Kaper, T.J. (California Inst. of Tech., Pasadena, CA (USA)); Wiggins, S. Los Alamos National Lab., NM (USA). [1989]. 16p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-48. (CONF-890794–2: 3. American Society of Civil Engineers/American Society of Mechanical Engineers mechanics conference, San Diego, CA (USA), 9-12 Jul 1989). Order Number DE90016718. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We present the outline and preliminary results of an analytical and numerical study of transport, mixing, and stretching in a chaotic Stokes' flow in a two-roll mill apparatus. We use the theory of dynamical systems to describe the rich behavior and structure exhibited by these flows. The main features are the homoclinic tangle which functions as the backbone of the chaotic mixing region, the Smale horseshoe, and the island chains. We then use our detailed knowledge of these structures to develop a theory of transport and stretching of fluid in the chaotic regime. In particular, we show how a specific set of tools for adiabatic chaos- the adiabatic Melnikov function lobe area and flux computations and the adiabatic switching method is ideally suited to develop this theory of transport, mixing and stretching in time-dependent two-dimensional Stokes' flows. 19 refs., 8 figs.

6450 High Energy Physics

Refer also to citation(s) 49096, 49887

49899 (DOE/ER/40231–T8) **Research program in elementary particle theory: Task A: Progress report ending December 31, 1990.** Balachandran, A.P.; Rosenzweig, C.; Schechter, J.; Wali, K.C. Syracuse Univ., NY (USA). 1990. 78p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER40231. Order Number DE90017284. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

Discussed in this paper is a brief account of the research work of the principal investigators and their co-workers during the past few years. The topics covered include: Topology in Physics; Skyrme Model; High Temperature Superconductivity; fractional statistics, and generalized spin statistics theorem; QCD as a dual chromomagnetic superconductor; confinement and string picture in QCD; quark gluon plasmas; cosmic strings; effective Lagrangians for QCD; "proton spin," "strange content" and related topics; physical basis of the Skyrme model; gauge theories and weak interactions; grand unification; Universal "see saw mechanism"; abelian and non-abelian interactions of a test string.

49900 (DOE/ER/40319–3) **Task A, High energy physics program experiment and theory: Task B, High energy physics program numerical simulation: Part 1 and 2, Progress report August 1, 1989–July 31, 1990.** Florida State Univ., Tallahassee, FL (USA). Dept. of Physics. [1990]. 77p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-87ER40319. Order Number DE90017336. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

This report discusses progress in experimental and theoretical High Energy Physics at Florida State University. Fixed target experiments, collider experiments, computing, networking, VAX upgrade, SSC preparation, detector development, and particle theory are some of the areas covered. (LSP)

49901 (KIFVE–88-08) **Proceedings of the seminar of young scientists HEPI AN Kaz SSR. Part 1: 1. High energy physics and computer technique.** AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. 44p. (In Russian). Order Number DE90706215. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Individual papers are processed separately for the data base. (DLC)

49902 (LBL–26455, pp. 148) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A measurement of the Lamb shift in lithiumlike uranium (U^{89+}) is in progress. The experiment uses a Doppler-tuned spectrometer (DTS) to measure the $2p_{1/2}$-$2s_{1/2}$ transition energy in lithiumlike uranium. The Lamb shift is about 75 eV out of a transition energy of about 280 eV. A prototype DTS was successfully tested using boron ions at the SuperHILAC. Six detectors for the Bevalac DTS were built and tested. The complete Doppler-tuned UV spectrometer, consisting of the six detectors, precision collimating slits, gas-absorber cells, target transporter, alignment apparatus, an electromagnetic for suppressing scattered electrons, scintillators for charged-particle vetos (protons from nuclear disintegrations), beam-position detectors, etc., was assembled in a 6-foot-diameter vacuum chamber, tested, and installed in the B40 cave at the Bevalac. Two 10-inch-diameter diffusion pumps were placed on the chamber to maintain vacuum against the diffusion of gas through the 4-μm-thick detector windows. (Very thin windows are necessary to transmit the low-energy x rays).

6451 Particle Interactions and Properties - Experimental

Refer also to citation(s) 49278, 49306, 49309, 49311, 49979, 49988, 49992, 49997

49903 (CEA-CONF–9959) **Production of light mesons in P + D reactions.** Boudard, A. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Moyenne Energie. 1989. 10p. (CONF-8907127–: 12. International Conference on Few Body Problems in Physics, Vancouver (Canada), 2-8 Jul 1989). Order Number DE91702096. Source: NTIS (US Sales Only), PC A02/MF A01.

Recent progress in our understanding of pd + ^{3}Heπ^0 up to 2.5 GeV is reviewed. The main contributions are known but the calculations do not reproduce details of the observables even in the Δ peak. The experimental data on neutral meson production at threshold up to the Φ (1020) is discussed. The measured high counting rate of η's provides a nice opportunity to study rare and forbidden η decays by the easy ^{3}He tagging.

49904 (CEA-CONF–10040) **Deuteron A(Q^2) structure function and the neutron electric form factor.** Platchkov, S. (and others); Amroun, A.; Auffret, S.; Cavedon, J.M.; Dreux, P.; Duclos, J.; Frois, B.; Goutte, D.; Hachemi, H.; Martino, J.; Sick, I. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Haute Energie. 1989. 6p. (CONF-8907127–: 12. international few body conference: few body problems in physics, Vancouver (Canada), 2-8 Jul 1989). Order Number DE91700504. Source: NTIS (US Sales Only), PC A02/MF A01.

We present new measurements of the deuteron A(Q^2) structure function in the momentum transfer region between 1 and 18 fm^{-2}. The accuracy of the data ranges from 2% to 6%. We investigate the sensitivity of A(Q^2) to the nucleon-nucleon interaction and to the neutron electric form factor G_E^n. Our analysis shows that below 20 fm^{-2} G_E^n can be inferred from these data with a significantly improved accuracy. The model dependence of this analysis is discussed.

49905 (CONF-900822–9) **Measurement of the $e^+e^- \rightarrow b\bar{b}$ cross section and forward-backward charge asymmetry at a center-of-mass energy of 57.2 GeV.** The AMY Collaboration. Louisiana State Univ., Baton Rouge, LA (USA). [1990]. 20p. Sponsored by Academia Sinicia of the People's Republic of China; U.S. DOE Energy Research; Japan Ministry of Education, Science and Culture; Korea Science and Engineering Foundation; National Science Foundation. DOE Contract AS05-77ER05490. From 25. IUPAP international conference on high energy physics; Singapore (Singapore); 2-8 Aug 1990. Order Number DE90017404. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Measurements of the $e^+e^- \rightarrow b\bar{b}$ forward-backward charge asymmetry, A_b, and the ratio of the cross-section for $e^+e^- \rightarrow b\bar{b}$ to the theoretical QED cross-section for $e^+e^- \rightarrow \mu^+\mu^-$, R_b, at an average center-of-mass energy of 57.2 GeV are reported. We use 196 multihadronic inclusive muon events corresponding to an integrated luminosity of 33.3 pb^{-1} accumulated by the AMY detector at TRISTAN. The results, $A_b = -0.82 \pm 0.25(\text{stat}) \pm 0.14(\text{syst})$ and $R_b = 0.47 \pm 0.12 \pm 0.10$ are consistent with the standard model predictions of -0.58 and 0.56, respectively. The results for the charge asymmetry are used to set a 90% confidence level limit on χ, the $B^0 - \bar{B}^0$ mixing parameter, of $\chi < 0.20$. 15 refs., 5 figs.

49906 (FRCEA-TH–283) **Pion electroproduction near threshold on protons: how reaching the axial form factor of nucleon. Preparatory study of the experiment and pion spectrometer realization.** Estenne, V. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Haute Energie; Lyon-1 Univ., 69 (France). 1988. 176p. (In French). Order Number DE91702090. Source: NTIS (US Sales Only), PC A09/MF A01.

This work aims to show the feasibility of a pion electroproduction experiment e+ p $\rightarrow$ e' π^+ n near the threshold on the protons of a liquid hydrogen target, by detecting in coincidence the outgoing pion and the scattered electron. This experiment is a collaboration between four laboratories (Clermont-LPC, Lyon-IPN, Orsay-IPN, Saclay-DphN/HE). Differential cross-sections will be measured in the threshold vicinity, following a double purpose: - Performing at the threshold, thanks to a justified extrapolation of the measured cross-sections, a transverse-longitudinal separation of the extrapolated term, in order to get separately both s-wave multipoles: their ratio will help to test theoretical models. - Reaching, through the transverse multipole, the nucleon axial form factor, with quadritransfers form 2 up to 5 fm^{-2}. We review how chiral symmetry and

currents algebra connect these two parameters. The building of a large solid angle, low energy pion spectrometer was necessary. Besides a complete description of the experimental set-up, we presents here for this non-parallel plane poles magnet a field modelisation,, whose results are compared with field values measured in the magnet symmetry plane. Installed at the Saclay Linear Accelerator, the apparatus operated satisfactorily during the first runs with the beam.

49907 (FSU-HEP–881011) **Searching for 100–300 GeV gluinos at the Tevatron and SSC.** Baer, H. (Florida State Univ., Tallahassee, FL (USA). Dept. of Physics); Tata, X.; Woodside, J. Florida State Univ., Tallahassee, FL (USA). [1988]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-87ER40319. (CONF-8806243–48: DPF summer study: Snowmass '88: high energy physics in the 1990s, Snowmass, CO (USA), 27 Jun - 15 jul 1988). Order Number DE90017449. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We examine event topologies from gluino pair production at various Tevatron upgrades, including the complete cascade decay of each gluino as given by the minimal supergravity model. We give expected rates for signal and background for 0 and 2 lepton(s) + n jet(s) + p_t events. We also examine whether the process of $pp \to \tilde{g}$ + LSP yields an observable p_t signature at the SSC, and conclude that it does only when $m_{\tilde{g}} \simeq m_{\tilde{g}} \lesssim 300$ GeV.

49908 (FSU-HEP–890130) **The search for very heavy top and the fourth generation.** Baer, H. Florida State Univ., Tallahassee, FL (USA). High Energy Physics Lab. Jan 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-87ER40319. (CONF-8811175–7: Beyond the standard model, Ames, IA (USA), 18-22 Nov 1988). Order Number DE90017318. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We examine prospects for detecting top quarks at hadron colliders if $m_t > M_W$. We find the top quark to be detectable above backgrounds for the entire theoretically allowed mass range of m_t, by looking at dilepton plus ≥ 2 jet events at the Tevatron $p\bar{p}$ collider. The top should also be seeable in single lepton events up to $m_t \simeq 180$ GeV, with a reconstructable mass. Prospects for detecting a fourth generation of fermions at the SSC are also discussed. 20 refs., 6 figs., 2 tabs.

49909 (HEPI–88-17) **Observation of the Dirac magnetic charges by virtue of a diffusion chamber.** Mikhajlov, V.F. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. 12p. Order Number DE91601103. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The beahviour of water drops, being condensated in ferromagnetic particles of a submicron size, in a magnetic field, in a light beam, suspended in gas atmosphere. A large number of objects observed has a magnetic charge, which value coincides with a charge of the Dirac monofield.

49910 (IFVE-OEF–89-95) **Study on the $\pi^+ \to \eta$ and $\pi^+ \to \pi^0\pi^0$ exclusive processes on nuclei at 10.5 GeV/c.** Akimenko, S.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij); Belousov, V.I.; Artykov, A.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 13p. (In Russian). Order Number DE91601108. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The charge exchange reactions $\pi^+ \to \eta$ and $\pi^+ \to \pi^0\pi^0$ were studied at 10.5 GeV/c with Be,Cu and Pb nuclei. The lead glass shower hodoscope was used to detect π^0- and η-mesons decaying as $\pi^0(\eta) \to 2\gamma$. The total and differential cross sections measured are compared with colour screening QCD-model, with Glauber theory calculations and with data at other energies. 13 refs.; 9 figs.; 1 tab.

49911 (IFVE-OTF–89-88) **Perspectives of experimental study of electromagnetic form factors of unstable particles at UNK.** Gershtejn, S.S.; Dzhikiya, G.V.; Likhoded, A.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 20p. (In Russian). Order Number DE91601104. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

To determine the main directions of the experimental explorations on the accelerators with a fixed target and the energy of the order of TeV possibilities of study of the pion and hyperon form-factors are discussed. The way of the investigations of effects of the SU(6)-symmetry breakdown in the electroproduction of baryon resonances is detected. Numerical estimations for the discussed problems were made for UNK IHEP energies. 15 refs.

49912 (IS-T–1488) **Measurement of α_s from energy-energy correlations in e^+e^- annihilation at 29 GeV.** Hsiao-Ying, Chao. Ames Lab., IA (USA). ©4 Sep 1990. 82p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Source: Iowa State University, Ames, IA 50011.

We have studied the energy-energy correlation in e^+e^- annihilation into hadrons at $\sqrt{s}$ = 29 GeV using the TPC/2γ Detector Facility at PEP. We found that $\alpha_s = 0.161 \pm .004 \pm .011$ for the average hadronic event sample using GKS matrix elements and LUND symmetric string fragmentation. 39 refs., 22 figs.

49913 (KEK–89-17, pp. 61-69) **Measurement of V_{ub}.** Sumiyoshi, Takayuki (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Nov 1989. (In Japanese). (CONF-8910393–: Workshop for asymmetric B-factory at KEK, Tsukuba (Japan), 2-4 Oct 1989). In *Proceedings of the workshop on asymmetric B factory at KEK.* Order Number DE90777869. Source: NTIS (US Sales Only), PC A12/MF A01.

V_{ub} is an element of the Kobayashi-Maskawa matrix which correlates the mass-specific state in the quark sector and the specific state of weak interaction. It represents the strength of the connection between the b quark and u quark. V_{ub} would not be zero if the CP violation can be expressed by the Kobayashi-Maskawa matrix. Measurement of V_{ub} is a major subject of experiments at B factories. V_{ub} may be determined from observation of the lepton's momentum distribution, non-leptonic decay and semi-leptonic decay. The present report focuses on Monte Carlo simulation to examine the feasibility of V_{ub} determination from the $B \to \pi 1\nu$ decay. It is assumed that the $B \to \pi 1\nu$ event involves e or μ leptons whose direction is 10deg or more from the beam axis, whose momentum perpendicular to the beam axis is 0.1 GeV/c or more, and whose momentum in a static B^0 meson system is between 2.3-2.7 GeV/c. The π meson is assumed to have an electric charge different from that of the e or μ lepton, and to be 200 μm or less away from the e or μ lepton. Results of the simulation suggest that one year measurement of the $B^0 \to \pi 1\nu$ decay made by an asymmetric collider in the Υ (4s) region could determine the V_{ub} value. (N.K.).

49914 (KEK–89-17, pp. 70-91) **Measurement of Bs-Bs-bar mixing.** Kamitani, Takuya (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Nov 1989. (In Japanese). (CONF-8910393–: Workshop for asymmetric B-factory at KEK, Tsukuba (Japan), 2-4 Oct 1989). In *Proceedings of the workshop on asymmetric B factory at KEK.* Order Number DE90777869. Source: NTIS (US Sales Only), PC A12/MF A01.

The study deals with a Monte Carlo simulation of Bs-Bs measurement through the collision of electrons and positrons having different energies. It also focuses on the feasibility of the determination of the mass difference parameter ($x_s = \Delta m_s/\Gamma$), and the optimization of the degree of asymmetry in the beam energies. If the mass difference parameter is 6.0 or so, it would be very likely that the value of the parameter can be determined from a sufficient number of events that correspond to one-year data. If the parameter is larger, the following three factors, which are affected by the degree of the asymmetry in collision energy, will be involved: a decrease in acceptance due to deformation of the angular distribution of particles toward the front, a decrease in resolution due to deformation of the angular distribution of particles toward the front and increased material passage, and an increase in time resolution due to an enhanced boost of B. Of these, the third factor has the greatest effect, indicating that a large asymmetry is desirable, though the other two factors can have a significant effect if the asymmetry is extremely large. (N.K.).

49915 (LAL–8935) **Study of neutrino oscillations in the frejus experiment.** Longuemare, C. (Caen Univ., 14 (FR). Lab. de

Physique Corpusculaire). Frejus Collaboration. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Oct 1989. 3p. (CONF-890903--: International Europhysics conference on high-energy physics, Madrid (Spain), 6-14 Sep 1989). Order Number DE91702100. Source: NTIS (US Sales Only), PC A02/MF A01.

The Frejus nucleon-decay detector has been operated between 19-02-1984 and 13-09-1988. The sample of atmospheric neutrino interactions recorded is compared with the predictions of a Monte Carlo simulation. A search for neutrino oscillations is performed. No evidence is found, and new limits on oscillations parameters are given at 95% CL.

49916 (LBL–26455, pp. 147-148) **Electron-impact ionization of U^{88+} - U^{91+}.** Claytor, N.; Feinberg, B.; Gould, H.; Bemis, C.E. Jr.; Gomez del Campo, J.; Ludemann, C.A.; Vane, C.R. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The authors have made the first measurements of electron-impact ionization cross sections for very high charged ions. The authors did this by channeling 407-MeV/nucleon U^{92+}, U^{91+}, U^{90+}, U^{89+}, and U^{88+} (bare uranium through beryllium-like uranium) along the <110> axis of 0.11-mm-thick and 0.37-mm-thick Si single crystals. For channeled ions, they observe a large reduction in the probability for ionization and a reduction in the probability for electron capture. The authors are able to determine the fraction of incident ions that channel and the density of electrons along the path of the ions that channel. They use these determinations to interpret their ionization data to yield cross sections for electron-impact ionization. Electron-impact cross sections were done for hydrogen-like-beryllium-like uranium by 220-keV electrons (the energy of the electrons seen in the rest frame of the 407-MeV/nucleon uranium). Their 1s and $2s^2$ results disagree with present theory. Our 2s and $2s^2$ results disagree with present theory. Their 2s and $2s^2$ results are not accurate enough to distinguish between theories.

49917 (ORNL/FTR–3732) **[Cross sections for lepton pair production and for capture of the pair-produced electrons to bound states of the fully-stripped projectiles]: Foreign trip report, July 18, 1990–August 31, 1990.** Dittner, P.F.; Krause, H.F.; Vane, C.R. Oak Ridge National Lab., TN (USA). 12 Sep 1990. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90017731. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The travelers spent approximately one month setting up, performing measurements, and then tearing down an experimental apparatus used to study various aspects of lepton pair production in collisions of 200-GeV/u sulfur ions with various targets. Results of the approximately ten days of beam-on-target measurement time are currently being evaluated. One traveler (HFK) learned about new theoretical investigations involving ion channeling in very thin crystals and its connections to catastrophe theory. The traveler discussed and began an investigation of a possible connection between the channeling rainbow and the channeling halo for very thin crystals.

6452 Particle Interactions and Properties - Theoretical

Refer also to citation(s) 49845, 49966, 50045

49918 (BNL–45004) **Resummation and the gluon damping rate in hot QCD.** Pisarski, R.D. Brookhaven National Lab., Upton, NY (USA). Aug 1990. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900570–11: 8. international conference on ultrarelativistic nucleus-nucleus collisions: Quark Matter '90, Menton (France), 7-11 May 1990). Order Number DE91000122. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

At high temperature a consistent perturbative expansion requires the resummation of an infinite subset of loop corrections into an effective expansion. This effective exansion is used to compute the gluon damping rate at leading order. 25 refs.

49919 (CBPF-NF–009/89) **Does there exist a gravitational analogue of the electro-weak unification.** Novello, M. Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1989. 11p. Order Number DE91601097. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

We examine the ideia of the existence of a new short range force mediated by massive spin 2 particles. We propose a model by means of which this force allows an unified description with gravity within the electro-weak SU (2) xU(1) model. (author).

49920 (CEA-CONF–10024) **Effective methods in QCD and the phenomenology of hadrons.** Chemtob, M. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique. 1989. 13p. (CONF-8903243–: Contribution to the Meeting of Saturne Theoreticians on Heavy Meson Production and Strangeness in Nuclei, Saclay (France), 16-17 Mar 1989). Order Number DE91700506. Source: NTIS (US Sales Only), PC A03/MF A01.

To place the problem in perspective I will first discuss the decoupling of heavy quarks in QCD which is a simpler perturbative problem. Then, I will review two experimental observables (the σ-term in πN scattering and the polarised deep inelastic scattering) which diagnose the possibility of non-perturbative effects associated with the decoupling of the strange quark and will next discuss their possible interpretation on the basis of the skyrme model. I will also present some simple-minded results for a related low-energy application to the meson-nucleon scattering lengths obtained in a chiral effective lagrangian approach.

49921 (CEA-CONF–10026) **Strange goings-on in the proton: a case for sheshire cat.** Rho, M. (State Univ. of New York, Stony Brook, NY (US). Dept. of Physics). CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique. 1989. 20p. Contract DE-FG02-88ER40388. (CONF-8905232–: 4. workshop on perspectives in nuclear physics at intermediate energies, Trieste (Italy), 8-12 May 1989). Order Number DE91700485. Source: NTIS (US Sales Only), PC A03/MF A01.

Three strange hadronic phenomena at low energy - the nucleon size problem, the strange quark content of the nucleon and the proton spin problem - are discussed in the context of manifestation of the Cheshire Cat Principle in hadronic systems. A simple resolution of these problems is provided by a chiral bag description combined with the topological notion of the baryon based on the skyrmion model. Absence of smoking-gun signals for quark-gluon presence in the nonperturbative sector of QCD is claimed to be a natural consequence of the Cheshire Cat Principle.

49922 (CEA-N–2624) **Generalized radiative corrections for hadronic targets.** Calan, C. de (Ecole Polytechnique, 91 - Palaiseau (FR). Centre de Physique Theorique); Navelet, H.; Picard, J. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire. Feb 1990. 66p. (In French). Order Number DE91702073. Source: NTIS (US Sales Only), PC A04/MF A01.

Besides the radiative corrections theory at the order α^2 for reactions involving an arbitrary number of particles, this report gives the complete formula for the correction factor δ in $d\sigma = d\sigma_{Born}(1 + \delta)$. The only approximation made here - unavoidable in this formulation - is to assume that the Born amplitude can be factorized. This calculation is valid for spin zero bosons. In the 1/2 fermion case, an extra contribution appears which has been analytically computed using a minor approximation. Special care has been devoted to the 1/v divergence of the amplitude near thresholds.

49923 (CEA-N–2640) **Classical treatment of the Compton collision in general relativity.** Paillere, P. CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France). Mar 1990. 23p. Order Number DE91700488. Source: NTIS (US Sales Only), PC A03/MF A01.

With the help of a precise definition of the photon 4-momentum in Riemannian geometry, one can calcutate the emerging frequency and velocity in a Compton Collision in General Relativity.

49924 (DOE/ER/05490–112) **Color flux distribution in pure SU(2) Lattice Gauge Theory.** Haymaker, R.W. (Louisiana State

Univ., Baton Rouge, LA (USA). Dept. of Physics and Astronomy); Peng, Yingcai; Singh, V.; Wosiek, J. Louisiana State Univ., Baton Rouge, LA (USA). Dept. of Physics and Astronomy. [1990]. 3p. Sponsored by U.S. DOE Energy Research; Polish Agency of Nuclear Energy. DOE Contract AS05-77ER05490. Grant CPBP-01.09;Grant CPBP-01.03;Grant RRI-14. (CONF-9006267--3: 1990 DPF summer study on high energy physics, Snowmass, CO (USA), 25 Jun - 13 jul 1990). Order Number DE90017403. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The color field distribution around a static $q\bar{q}$ pair is studied in detail for pure SU(2) Lattice Gauge Theory in four dimensions. As a result of large cancellations between electric and magnetic components, the action density dominates the energy density typically by an order of magnitude, at points far from the quarks.

49925 (IAE--4904-1) **Filamentation in quark plasma at finite temperatures.** Pokrovskij, Yu.E.; Selikhov, A.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 25p. (In Russian). Order Number DE91601048. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The initial (linear) stage of filamentary instability (the Weibel instability) which in the system of two-counter quark fluxes develops faster than others has been considered in terms of the non-Abelian Vlasov-Yang-Mills equations for quark plasma in a mean gluon field. A parametric method is proposed for the analytical solution of the dispersion equation at an arbitrary relationship between flux temperatures and quark masses. It is shown that the experimental exhibition of the Weibel instability can be applied to search for and study the initial highly-instable two-flux stage of production of quark-gluon plasma (QCP) in the central collisions of ions at E_{lab}=10-200 GeV/nucleon. 17 refs.; 7 figs.; 1 tab.

49926 (IFUSP-P--814) **Double beta decay, neutrino physics, nuclear structure and isospin and spin-isospin symmetries.** Krmpotic, F. (La Plata Univ. Nacional (Argentina). Dept. de Fisica). Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Dec 1989. 50p. Order Number DE91601028. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Prominent features of the double beta decay processes are reviewed. Emphasis is placed on the neutrino masses and the quasiparticle random phase approximation (GRPA). The suppression mechanism for the $\beta\beta$-decay transition rates, proposed by Vogel and Zirnbauer, is found to be closely related to the restoration of SU(4) symmetry. It is suggested that the extreme sensitivity of the $\beta\beta$-decay amplitude on the proton-neutron coupling is a consequence of the explicit violation of the SU(4) symmetry and therefore an artifact of the model. A prescription is given for fixing this interaction strength within the GRPA itself, which in this way acquires predicting power on both single and double β-decay lifetimes. (author).

49927 (IFVE-ONF--89-93) **On energy dependence of the width and shape of the rapidity distribution of negatively charged particles.** Uvarov, V.A.; Shlyapnikov, P.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 10p. (In Russian). Order Number DE91601049. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Experimental data on the rapidity distribution of the negatively charged particles in the broad c.m.s. energy range from a few GeV to $\sqrt{s}$=900 GeV are analyzed. It is shown that the energy dependence of the width of the rapidity distribution in all available energy range can be described by a simple logarithmic function and that the distribution $(d6/dy)/(d6/dy)_{y=0}$ in the sufficiently large region of the central plateau can be represented as an energy independent function of y/Y, where $Y=\ln(\sqrt{s}/m)$ and m the parameter. 30 refs.; 3 figs.

49928 (IFVE-ONF--89-94) **Determination of value of the $\sigma(\nu\text{-barn}\rightarrow\mu^{\pm}X)\sigma(\nu\text{-berp}\rightarrow\mu^{\pm}X)$ cross section ratio at neutrino energies up to 30 GeV.** Brunner, J. (Akademie der Wissenschaften der DDR, Berlin-Zeuthen. Inst. fuer Hochenergiephysik (German Democratic Republic)); Kaufmann, H.H.; Grabosch, H.J.; Ammosov, V.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 8p. (In Russian). Order Number DE91601029. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The paper presents the results of measuring the total cross-section ratios in channel of charged-current interactions of neutrino (antineutrino) with neutrons and protons $R_{\nu bar}=\sigma(\nu\text{-barn})/\sigma(\nu\text{-barp})$. The results $R_{\nu}=2.22\pm0.21$, $R_{\nu bar}=0.45\pm0.12$ are in agreement with quark-parton-model predictions. For neutrino interactions the dependence of R_{ν} on Bjorken variables x and y have also been studied. 17 refs., 5 figs.

49929 (IFVE-OTF--88-148) **One-gluon exchange approximation for quasipotential of two-quark interaction in quantum chromodynamics.** Arkhipov, A.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. 24p. Order Number DE91601050. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Submitted to TMF.

By the method of a single-time reduction of the Bethe-Salpeter formalism for two-fermion system, analytical expressions for the potentials of quark-quark and quark-antiquark interactions in QCD have been obtained in one-gluon exchange approximation. The asymptotic properties of quark-quark forces in configuration space have been studied. The dynamic equation for the wave function of meson as a quark-antiquark bound state has been derived in one-gluon exchange approximation. 18 refs.

49930 (IFVE-OTF--89-66) **Model of chromoelectric charges confinement.** Alekseev, A.I.; Arbuzov, B.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 8p. Order Number DE91601055. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Submitted to Phys. Lett., B.

The problem of a consistent description of small and large distances in QCD is considered. For large distances the effective action for gluon field corresponds to the singular infrared asymptotics of a gluon propagator. Proceeding from the principle the static spherically-symmetric nonabelian solutions are constructed. They are model description of hadrons. The size of perturbative region and vacuum energy density are estimated. 11 refs.

49931 (IFVE-OTF--89-75) **Supersymmetric version of horizontal gauge interactions.** Amaglobeli, A.N. (AN Gruzinskoj SSR, Tbilisi (USSR). Tbilisskij Matematicheskij Inst.); Kereselidze, A.R.; Liparteliani, A.G.; Volkov, G.G. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 26p. Order Number DE91601056. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The supersymmetric version of the horizontal gauge model for 3 and 4 quark-lepton generations is considered. The possible contributions of horizontal interactions in classes of rare processes such as: oscillations $K^0\rightleftarrows K\text{-bar}^0$, $B_d^0\rightleftarrows B\text{-bar}_d^0$, $B_s^0\rightleftarrows B_s^0$, semileptonic processes (μ-e-conversion) and in the leptonic decays $\mu\rightarrow 3e$ and $\mu\rightarrow e\gamma$ are studied. Its shown that violations of local horizontal gauge symmetry of amplitude values of experimental restrictions of the above processes for some variants considered do not contradict the existence of light gauge bosons (m_H>or approx. 1-10 TeV) and calibrino (m_H>or approx. 0.2-0.5 TeV). 16 refs.

49932 (IFVE-OTF--89-87) **Massive straight-line string as a model of heavy quarkonium.** Batunin, A.V.; Zorin, O.L. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 19p. (In Russian). Order Number DE91601057. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Submitted to Nucl. Physics.

A system of two massive quarks connected with a straight-line relativistic string is investigated to be applied for heavy meson spectriscopy description. In terms of a vector string field the interaction vertices for charmonium excitations belonging to the triplet of the leading Regge trajectories are constructed. A constructional scheme for interaction proposed earlier for straight-line string with massless quarks is used. 9 refs.; 4 figs.

49933 (IFVE-OTF–89-110) **Excited quark production at ep and γp colliders.** Dzhikia, G.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 24p. Order Number DE91601051. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The production of excited quarks q* of spin j predicted by composite models at ep and γp colliders HERA, LEP-LHC and UNK-VLEPP has been studied. The production of excited quarks of spin j=1/2 at the γp collider based on the ep collider UNK-VLEPP is also considered. The effect of the longitudinal polarization of the electron beam is analyzed and the standard model background is estimated. It is shown that excited quarks with masses of the order of 1-2 TeV can be studied, and ep(γp) colliders have additional capabilities in exploring the structure of interactions of q* in comparison to hadron colliders. 21 refs.; 10 figs.; 2 tabs.

49934 (IFVE-OTF–89-111) **Strange meson mass spectrum in relativistic model for quasi-independent quarks.** Khrushchev, V.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 9p. Order Number DE91601052. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

In the framework of the quasi-independent quark model with the selection rules the mass formula for radially and orbitally excited states of light mesons with I=1/2 is proposed. The calculated mass values coincide with experimental ones within 6% accuracy. The mass formula may be used for the new meson experiment proposals. 35 refs.; 2 tabs.

49935 (IFVE-OTF–89-136) **Relativistic massive particle with higher curvatures as a model for description of bosons and fermions.** Plyushchaj, M.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 11p. Order Number DE91601025. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Submitted to Phys. Lett. B.

The model of a massive relativistic particle are proposed in which the world trajectory of the particle is supplied with a system of normals. In addition to the term, proportional to the length of the world trajectory, the action of these models includes some additional term, ΔA, depending in d=4 on higher curvatures of the trajectory. On the quantum level, the models describe states of an arbitrary fixed integer, or half-integer spin, according to the values of the quantized parameters in ΔA. 4 refs.

49936 (IFVE-OTF–89-140) **Numerical study of equation for gluonic cascade with recombination.** Batunin, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij); Belodedov, M.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 5p. Order Number DE91601053. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Submitted to Yad. Fiz.

The equation for the generating function of gluon distribution in a cascade with recombination is numerically investigated at different initial numbers of gluons m and generation vertices. The solution to this equation is found to exponentially tend to steady-state one and the exponent is proportioal to both m and α. 3 refs.; 3 figs.

49937 (IFVE-OTF–89-144) **On mixing of states in relativistic-invariant theory.** Nekrasov, M.L. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 14p. (In Russian). Order Number DE91601054. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The status of the state-mixing model in relativistic-invariant theory is discussed. The viewpoint that this model is inapplicable for a deep study of the nature of neutral exotic mesons is reasoned. In relativistic-invariant model of composite interpolating operators it is shown that the state mixing matrix is not relativistic-invariant, depends on the properties of the expansion basis and does not possess the orthogonality property. The numeric estimates are presented for pseudoscalar η and η' mesons. 12 refs.

49938 (INS–819) **Extra weak bosons in a confining gauge theory with complementarity.** Yasue, Masaki. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Apr 1990. 25p. Order Number DE90520226. Source: NTIS (US Sales Only), PC A03/MF A01.

In composite models of weak bosons based on a confining gauge theory, extra weak bosons introduced as composites of scalar constituents are shown to exhibit kinetic mixing interactions describing the vector meson dominance of the photon and to disguise themselves as massive elementary gauge particles in accord with the notion of complementarity. Detailed discussions are presented for a $U(1)_{em}^{loc}$ model with a confined $SU(2)_L^{loc} \times G^{loc}$ gauge symmetry, where $G^{loc} = SU(2)_L^{loc} \times SU(2)_R^{loc}$, which is responsible for compositeness of quarks and leptons as well. Also discussed is complementarity in QCD for baryons and vector mesons. (author).

49939 (INS–821) **More sum rules for quark and lepton masses.** Terazawa, Hidezumi. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Apr 1990. 11p. Order Number DE90520260. Source: NTIS (US Sales Only), PC A03/MF A01.

Sum rules for quark and lepton masses are derived from the Ward identity of Chanowitz and Ellis for the vertex function of the trace of the energy-momentum tensor and the two axial-vector currents and the partially conserved axial-vector current hypothesis. They indicate, among other things, that the constituent quark masses of u and d and those of the techniquarks, if any, are about 300 MeV and 300 GeV, respectively. (author).

49940 (ITEP–121-88) **Analysis of the reaction p-barp→Λ-barΛ near the threshold.** Kudryavtsev, A.E.; Samojlov, V.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1988. 12p. Order Number DE91601059. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Analysis of the p-barp→Λ-barΛ reaction is made in the nearthreshold energy region $E_{\Lambda-bar\Lambda} \approx$ 1-25 MeV. The observed anisotropy of the cross section is connected with strong suppression of S-waves due to absorption in the initial and final states. 8 refs.; 4 figs.

49941 (ITEP–131-88) **Quantum chromodynamics with infinite number of vector mesons.** Geshkenbejn, B.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1988. 21p. Order Number DE91601060. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Families of vector mesons Rho,Ψ,Υ, contain an infinite number of resonances with gradually increasing widths are considered. The asymptotic freedom requirement involves a relationship between the electric width of k-th resonance and its mass M_k derivative over the number k. It is shown that for the families of Ψ and Υ mesons the moment from experimental function R(s) is equal to the sum of the moment from a bare quark loop and the edge term which stems from replacing of summation by integration. These equalities are fulfilled up to 1% for 60 moments in the Ψ-meson family and up to 2% for 96 moments in the Υ-meson family. The electronic widths of the resonances and the Rho-meson mass are calculated. 7 refs.

49942 (ITEP–152-88) **Topics in low-energy p-barp interactions.** Kerbikov, B.O. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1988. 29p. Order Number DE91601061. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Theoretical interpretations of several new experimental results on low-energy p-barp interactions are presented. An effective range analysis of the LEAR data on p-barp elastic scattering and p-barp→n-barn charge-exchange reaction is carried out. Tentative reasons for the unusual behaviour of the real-to-imaginary ratio of the p-barp forward elastic scattering amplitude are pointed out. Restrictions on the NN-bar amplitude imposed by the strong interaction shift and width of the 1S-state of the antiprotonic hydrogen are derived. Evidence for the appearance of the Barry topological phase in antiprotonic hydrogen is presented. 50 refs.; 3 figs.

49943 (ITF–88-104) **A three-dimensional model of separable potential interaction at high energies.** Katerinchuk, P.A.;

Peresypkin, V.V.; Kharchenko, V.F. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1988. 12p. (In Russian). Order Number DE91601062. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A phenomenological model of high-energy two-particle potential scattering that makes no use of the Green function approximation and admits an analytic solution to the scattering problem with arbitrary transferred momenta is suggested. 6 refs.; 6 tabs.

49944 (ITF–88-145) **Method of exact solutions in investigating the electromagnetic field influence on different quantum processes.** Studenikin, A.I. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1988. 20p. (In Russian). Order Number DE91601030. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Using the method of exact solutions of equations for the wave functions of particles, the following problems are studied in the presence of electromagnetic fields: (1) the polarization effects in the neutrino emission by an electron and e^+e^--pair annihilation into spinless bosons in magnetic field, (2) the effects of proton pure recoil in the β-decay of a neutron in a magnetic field, (3) the contributions of bosons of different types and composite Z,W and H bosons to the anomalous magnetic moment of a charged lepton moving in a magnetic field, (4) the stimulated emission and absorption of an electron in the electromagnetic field of Redmond configuration, (5) the theorem of equivalence of expressions for the probabilities of the processes $e \to e+\nu+\nu$ and $e \to e+Z$ in constant fields. 33 refs.

49945 (ITP–88-116) **An off-energy description of hadron-hadron interaction within the P-matrix approach.** Sitenko, A.G.; Petrov, N.M.; Babenko, V.A. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1988. 9p. Order Number DE91601038. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

It is shown that within the P-matrix approach the off-energy scattering amplitude can be determined using the solution of the inverse scattering problem. 4 refs.

49946 (ITP–88-117) **Study of the effects in three-nucleon systems due to the violation of nuclear forces charge independence.** Petrov, N.M. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1988. 8p. Order Number DE91601063. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The triton binding energy and nd-interaction doublet length are calculated for different versions of charge-dependent nucleon-nucleon forces. The possibility to gain information on neutron-neutron interaction using the three nucleon motion problem is exhibited. 10 refs.; 2 figs.

49947 (ITP–88-126) **Light quark mass relations from finite energy sum rules.** Grdlichka, E.S.; Jenkovszky, L.L.; Struminsky, B.V. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1988. 7p. Order Number DE91601098. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Sums and differences of light quark masses are calculated from finite energy sum rules (FESR) with Gaussian out-off. 11 refs.; 1 tab.

49948 (ITP–88-175) **Saturation of hadron process at high energies: alternative approaches to its realization.** Glushko, N.I.; Kobylinskij, N.A. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1989. 25p. Order Number DE91601064. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The methods used to construct the amplitudes in which the Froissart bound is saturated are classified and discussed. Analysis is made of a rather flexible parametrization combining some principally different cases. It is shown that the data cannot choose the type of the unitary representation for the scattering amplitude but they obviously point out to the Froissart component of the amplitude not to be related to the glueball reggeons. 33 refs.; 9 figs.; 2 tabs.

49949 (JINR-E–2-89-145) **Electroweak radiative corrections to deep inelastic scattering at HERA. Charged current scattering.** Bardin, D.Yu.; Burdik, C.; Christova, P.Ch.; Riemann, T. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1989. 16p. Order Number DE91601031. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Submitted to Z. Phys., C.

Analytic results are presented on electroweak radiative correction for charged-current deep-inelastic electron proton scattering at HERA energies. Contributions of one loop and radiative corrections are calculated separately. Infrared divergences are reduced and mass singularities are simplified. Single photon bremsstrahlung is included without cuts. 11 refs.; 5 figs.

49950 (JINR-R–1-89-64) **An impact parameter analysis of antiproton-proton elastic and inelastic scattering at 22.4 GeV/c.** Zlatanov, Z. (Vissh Khimiko-Tekhnologicheski Inst., Sofia (Bulgaria)); Kubik, V.M.; Tikhonova, L.A. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. 1989. 10p. (In Russian). Order Number DE91601065. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The properties of elastic and inelastic p-barp-interactions at 22.4 GeV/c were studied as a function of impact parameters. The data were obtained using BC LUDMILA. The estimates of hadron transparency and of mean inelastic interaction radius square were obtained. In the framework of simple geometrical Monte-Carlo model for inelastic collisions the effective radii of hadrons and valons were estimated. 17 refs.; 6 figs.

49951 (JINR-R–2-89-86) **Decays of η- and K_L-mesons into a lepton pair: three-dimensional theory and phenomenology.** Kozlov, G.A. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1989. 20p. (In Russian). Order Number DE91601066. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Submitted to Int. J. Mod. Phys., A.

Probabilities of the decays $\eta \to e^+e^-$, $\eta \to \mu^+\mu^-$ are calculated in the quark-loop model with a quark-meson vertex function dependent on the relative momentum of u(u-bar) d(d-bar)- and s(s-bar)-quarks. The two-photon transitional form factor is determined by the three-dimensional relativistic wave function of a bond (by a confinement potential of the oscillatory type) state of a quark and antiquark. Dispersive parts of the amplitudes of lepton decays of π^0, η-, η'-mesons are used to estimate the widths of $K_L \to e^+e^-$, $K_L \to \mu^+\mu^-$-decays in the model of dominating one-particle pole states and the theoretical results thus obtained are compared with experimental data. 26 refs., 1 fig., 3 tabs.

49952 (KEK–89-17, pp. 42-47) **B meson physics on Υ (4s).** Tanimoto, Morimitsu (Ehime Univ., Matsuyama (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Nov 1989. (CONF-8910393–: Workshop for asymmetric B-factory at KEK, Tsukuba (Japan), 2-4 Oct 1989). In *Proceedings of the workshop on asymmetric B factory at KEK.* Order Number DE90777869. Source: NTIS (US Sales Only), PC A12/MF A01.

The charmless non-leptonic decays of the B meson are expected to provide a sensitive test of the standard model. In particular, the processes involving three s-quarks in the final state are rare decay modes because these dominant processes are loop-induced $b \to sg$ transitions, or so-called penguin diagrams. One typical mode of these rare decays is the $B \to K\phi$ process. The charmless decays through the penguin process have another source of CP violation, so new physics such as the fourth generation, SUSY and the three Higgs doublets models may play an important role in the CP violation of these decays. An investigation is made here of the contribution of the fourth generation to the CP violation in the $B \to K\phi$ decay. An analysis is made of the CP violating asymmetries of the $K\phi$ decay of the charged B mesons and the neutral B mesons on Υ (4s), which is advantageous to observation of the effect of new physics. The branching ratio of $B \to K\phi$ is 1×10^{-5} and consequently, a 3σ effect would require at least 10^{10} Υ (4s)'s if the asymmetry is of an order of 1%, but 10^7-10^8 Υ (4s)'s if it is $\pm 15\%$. Since 10^6-10^7 Υ (4s)'s are attainable at CESR(Υ 4s), it is expected that the fourth generation effect will be observed in the $B_u^{\pm} \to K^{\pm}\phi$, $B_d^0 \to K_s\phi$ and $B_d^0 \to K_s\phi$ processes on Υ (4s). (N.K.).

49953 (KEK–89-17, pp. 55-60) **Comparison of B factories.** Abe, Kazuo (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Nov 1989. (In Japanese). (CONF-8910393–:

Workshop for asymmetric B-factory at KEK, Tsukuba (Japan), 2-4 Oct 1989). In *Proceedings of the workshop on asymmetric B factory at KEK.* Order Number DE90777869. Source: NTIS (US Sales Only), PC A12/MF A01.

The B factory is a high-strength accelerator that is designed to study the origins of the flavor and CP violation through accurate measurement of the decay of B mesons. This type of accelerators can be divided into three groups. Those used at DORIS (West Germany) and CESR (U.S.), called symmetric colliders, are intended to cause electrons and positrons having the same energy to collide with each other to produce a BB resonance state. Compared to these, an accelerator designed to produce a BB resonance state by causing electrons and positrons with different energies to collide is called an asymmetric collider. The present study compares the accelerator at CESR, the one at LEP, and the asymmetric collider at KEK. Their luminosity, the number and type of B mesons to be formed, and events to be observed are tabulated. Their comparison is also made with respect to major physical quantities hoped to be determined from B meson experiments, possible methods for them, and their advantages. Such major physical quantities include the probability of the decay from the b quark to the u quark, the mixing of Bs mesons and their anti-particles, and the CP violation. (N.K.).

49954 (KIFVE–88-08, pp. 35-38) **Probable method of $W^{\pm}$-boson mass and widths measurements.** Ivkin, A.V.; Nazirov, M.T. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. (In Russian). In *Proceedings of the seminar of young scientists HEPI AN Kaz SSR. Part 1: 1. High energy physics and computer technique.* Order Number DE90706215. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The method for measuring mass and width of W-boson decay according to the features of a spectrum of their bremsstrahlung electromagnetic radiation is suggested. Differential cross section of reaction $e^+e^- \rightarrow W^+W^-\gamma$ in the approximation of soft photons is calculated. It is shown that the method operates better at high energies when W-bosons producing are relativistic. 2 refs.; 1 fig.

49955 (KIFVE–88-08, pp. 29-34) **Sensitivity of angular distribution of high energy muon flux from atmosphere to hadron charm production parameters.** Madigozhin, D.T. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. (In Russian). In *Proceedings of the seminar of young scientists HEPI AN Kaz SSR. Part 1: 1. High energy physics and computer technique.* Order Number DE90706215. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Angular distribution of a muon component of cosmic rays of high energies with account of contribution to the flux of muons of charm particle decay is calculated analytically at scaling approximation. Sensitivity of angular distribution to charm particle production cross section is investigated. The upper boundary of a part of charm particle production cross section out of total inelastic cross section in the energy region from 100 to 300 TeV, equalling 0.125, is obtained on the basis of comparison with the experiment according to muon recording by X-ray emulsion chambers. 7 refs.; 1 fig.

49956 (KIFVE–88-15) **Possible change of growth regime for the total cross section of hadron processes at E_0 >or approx. 10^{15} eV.** Kuchin, I.A. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. 17p. (In Russian). Order Number DE91601068. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

In the framework of the analogy between the elastic scattering of hadrons as composite particles and Raman scattering of the light, a probable nature of the two-componentness of the strong interaction at high-energy region is discussed. Possible cause and character of the change of the elementary act with energy growth are pointed out. It is shown that the just observed rise of the pp total cross section $\approx \ln^2 s$ may be considered as the indication to the transition's beginning to more sharp increase of the cross section in the region E_0 >or approx. 10^{15} eV. 24 refs.; 3 figs.

49957 (RAL–90-030) **Amplitude analysis of $\gamma\gamma \rightarrow \pi\pi$ from threshold to 1.4 GeV.** Morgan, D. (Rutherford Appleton Lab., Chilton (UK)); Pennington, M.R. Rutherford Appleton Lab., Chilton (UK). May 1990. 30p. (DTP–90-24). Order Number DE91601032. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A new amplitude analysis of results on $\gamma\gamma \rightarrow \pi^+\pi^-$ from the Mark II and $\gamma\gamma \rightarrow \pi^0\pi^0$ from the Crystal Ball experiments is reported. Key constraints from the low energy theorem and from analyticity and unitarity that relate $\gamma\gamma \rightarrow \pi\pi$ to other meson scattering reactions are built into the trial forms. Despite these restrictions, the limited angular coverage of the experiments means that solutions with quite different proportions of S wave and D waves of both helicities 0 and 2 are admitted above 1 GeV. This leads to a much wider range of possibilities for the couplings of the broad resonances $f_0(\epsilon)$ and $F_2(1270)$ than is commonly supposed. The better fits have Γsub $_{f0}$ in excess of 4 keV and a ratio of Γsub $_{f0}/\Gamma_{f2}$ greater than 2. (Author).

6453 Particle Invariance Principles and Symmetries

Refer also to citation(s) 50018

49958 (IFUSP-P–837) **Symmetries of Chern-Simons theory in Landau gauge.** Damgaard, P.H. (Copenhagen Univ. (Denmark). The Niels Bohr Institute); Rivelles, V.O. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Apr 1990. 10p. Order Number DE91600566. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

In d=3 dimensions the IOSp(d/2) algebra admits a non-trivial modification. It is shown that 3-dimensional Chern-Simons theory in Landau gauge has a global symmetry based on this large Lie superalgebra. (author).

49959 (IFUSP-P–838) **BRST quantization of spinning relativistic particles with extended supersymmetries.** Pierri, M.; Rivelles, V.O. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Apr 1990. 12p. Order Number DE91600567. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

We perform the calculation of the transition amplitude for spinning relativistic particles with N-extended supersymmetries using the BRST-BFV technique. The resulting transition amplitude can be interpreted in a field theory context as the Feynman propagator for the field strenght of a field with spin N/2. We also show that there is a global anomaly for odd dimensions so that the model is consistent only for even dimensions. The gauge invariance of the respective field theory does not become manifest in this formulation. (author).

49960 (KEK–89-17, pp. 48-54) **CP violating decay of neutral B meson.** Wakaizumi, Seiichi (Tokushima Univ. (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Nov 1989. (In Japanese). (CONF-8910393–: Workshop for asymmetric B-factory at KEK, Tsukuba (Japan), 2-4 Oct 1989). In *Proceedings of the workshop on asymmetric B factory at KEK.* Order Number DE90777869. Source: NTIS (US Sales Only), PC A12/MF A01.

The report focuses on the CP violation in the decay of neutral mesons, hadronic decay through mixing of B_d and B_s mesons, and time dependence of the CP asymmetry. It is shown that B_d-B_d mixing is large, indicating that a large CP asymmetry could be involved in the hadron decay of B_d and B_s mesons. If a CP asymmetry above 10%, much higher than the 2-3% asymmetry expected from the third generation standard model for the $B_s \rightarrow D^+D^-$ and F^+F^- modes, should be found in experiments, it could indicate the existence of 'new physics', such the existence of the fourth generation, which could not be covered by the standard model. A CP asymmetry tagged with lepton on Υ (4s) is likely to show a strong time dependence in such modes as $B_d \rightarrow \Upsilon\pi^+\pi^-$, D^+D^- and F^+F^-. If the fourth generation exists, new evidence that is not found in the standard model might be identified in the $B_d \rightarrow D^+D^-$ and F^+F^- mode in a region where the time difference between the two vertices is small. (N.K.).

49961 (KEK–89-17, pp. 92-110) **A study on CP violation.** Ozaki, Hitoshi (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Nov 1989. (In Japanese). (CONF-8910393–: Workshop for asymmetric B-factory at KEK, Tsukuba (Japan), 2-4 Oct 1989). In *Proceedings of the workshop on asymmetric B factory at KEK.* Order Number DE90777869. Source: NTIS (US Sales Only), PC A12/MF A01.

The study focuses on the estimation of the integral luminosity required to observe the CP violation in the $B^0 \rightarrow \Psi K_s$ reaction. As in a

K meson system, different CP violating phenomena are likely to occur in a B meson system. The B factory at KEK is intended particularly for those reactions that end in a characteristic CP state. In such a case, CP violation takes place as interference between the amplitude associated with the direct decay from a B^0 meson to a final state and that associated with the decay from an anti-B^0 meson to a final state through B-anti-B mixing. Major ones of such final states include ΨK_s and $\pi\pi$, and the associated CP violation has the features that the degree of asymmetry is high (10%) and that the degree of asymmetry can be expressed by the Kobayashi-Maskawa matrix. The Kobayashi-Maskawa mechanism of quarks can be checked most directly by measuring the degree of asymmetry. An equation is derived for the integral luminosity required for measuring CP violation factors by means of an asymmetric e^+e^- accelerator, and various parameters included in the equation are described. Luminosity calculations are made and results are discussed. (N.K.).

6454 Field Theory

Refer also to citation(s) 49887, 49918, 49924

49962 (CBPF-NF–003/89) **Separable coordinates and particle creation III: Accelerating, Rindler and Milne vacua.** Costa, I.; Svaiter, N.F. Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1989. 15p. Order Number DE91600515. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

We compare the two vacua associated with accelerating observers to Rindler vacuum and to the Milne vacua, by means of Bogolubov coefficients. This confirm previous results of the literature that say that two of these vacua are equivalent to Cartesian vacuum, and the three others behave like a thermal gas in the Cartesian vacuum. (author).

49963 (CEA-CONF–10037) **Notes on some algebraic structures common to integrable lattice systems and conformal field theories.** Saleur, H. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique. 1989. 14p. (CONF-8907217–: 8. Symposium on Theoretical Physics, Sokcho (Republic of Korea), 3-8 Jul 1989). Order Number DE91700510. Source: NTIS (US Sales Only), PC A03/MF A01.

The relations between integrable systems and conformal field theories have first been worked out in the continuum limit. Using Coulomb gas and Bethe ansatz techniques, critical exponents and partition functions were obtained for various lattice models giving exact results of practical interest as well as a precise correspondence with conformal theories. It was later realized that the two subjects exhibit numerous similarities, and although this is maybe unexpected a priori, that some prints of the conformal invariant structure are present on the lattice before the continuum limit. We review here recent progress on this question.

49964 (IFUSP-P–834) **Selection of collective degrees of freedom in the boson space.** Menezes, D.P. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Yoshinaga, N. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Apr 1990. 21p. Order Number DE91600516. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Two methods for selecting collective bosons, one proposed by Klein and Vallieres and the other one being a number conserved Tamm Dancoff method, are applied in this work to boson mapping methods. The first mapping to be tested is a Dyson boson mapping in the SD shell and the second one is a mapping developed by Bonatsos, Klein and Li and applied to two j-shells with $|j_1 - j_2| = 4$. Whenever the boson mappings are accurate, the selection of collective bosons gives good results, independently of the method considered. (author).

49965 (IFUSP-P–842) **Gauge structure, anomalies and mass generation in a three dimensional thirring model.** Gomes, M.; Mendes, R.S.; Ribeiro, R.F.; Silva, A.J. da. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. May 1990. 28p. Order Number DE91600517. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

We consider a three dimensional model of spinor fields with a Thirring like, quadrilinear self interaction. Using either two or four component Dirac spinors, we prove that the 1/N expansion for the model is renormalizable if a gauge structure to select physical quantities is introduced. For certain values of the coupling the leading 1/N approximation exhibits bound state poles. Dynamical breaking of parity or chiral symmetry is shown to occur as a cooperative effect of different orders of 1/N, if N is smaller than the critical value $N_c = {}^{128}/_{\pi^2 D}$, where D is two or four depending on wether the fermion field has two or four components. (author).

49966 (IFVE-OTF–88-147) **Single-time reduction of bethe-salpeter formalism for two-fermion system.** Arkhipov, A.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. 44p. Order Number DE91600518. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Submitted to Intern. J. Mod. Phys. A.

The single-time reduction method proposed in other refs. for the system of two scalar particles is generalized for the case of two-fermion system. A self-consistent procedure of single-time reduction has been constructed both in terms of the Bethe-Salpeter wave function and in terms of the Green's function of two-fermion system. Three-dimensional dynamic equations have been obtained for single-time wave functions and two-time Green's functions of a two-fermion system and the Schroedinger structure of the equations obtained is shown to be a consequence of the causality structure of the local QFT. 32 refs.

49967 (ITF–88-111) **Bound states and the formalism of composite operators in gauge theories.** Gusynin, V.P.; Kushnir, V.A.; Miranskij, V.A. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1988. 25p. (In Russian). Order Number DE91600520. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A formalism for describing the Green's functions of composite operators on nonperturbative vacuum is suggested. In the ladder approximation the formalism is applied to determine the Green's functions of composite operators in vector-like gauge theories. The properties of scalar and pseudoscalar bound states in the dynamical regime with a nontrivial fixed point are considered. The hypothesis of a partially conserved dilation current in such a dynamical regime is discussed. 11 refs.; 10 figs.

49968 (ITF–88-176) **On zero modes of the Dirac operator on noncompact two-dimensional surface in magnetic field.** Sitenko, Yu.A. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1989. 12p. (In Russian). Order Number DE91600521. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Zero modes of the two-dimensional Dirac operator on a noncompact single-connected surface in an external magnetic field are considered. The number of square integrable zero modes is shown to be determined by the global characteristics of the external field and the surface: the magnetic flux through the surface and the Gauss curvature are integrated over the surface. The equivalence of the square integrability condition to the conditions of the index theorem for a closed compact surface is discussed. 13 refs.

49969 (ITP–88-156) **Seeley-Gilkey coefficients for the fourth-order operators on a Riemannian manifold.** Gusynin, V.P. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1989. 24p. Order Number DE91600522. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A new covariant method for computing the coefficients in the heat kernel expansion is suggested. It allows one to calculate Seeley-Gilkey coefficients for both minimal and nonminimal differential operators acting on a vector bundle over a Riemannian manifold. The coefficients for the fourth-order minimal operators in arbitrary dimension of the space are calculated. In contrast to the second-order operators the coefficients for the fourth-order (and higher) operators turn out to be essentially dependent on the space dimension. The algorithmic character of the method suggested allows one to calculate coefficients by computer using the analytical calculation system. 19 refs.; 1 fig.

49970 (JINR-E–2-89-39) **On the origin of the Schwinger anomaly.** Vladimirov, A.A. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1989. 6p. Order Number

DE91600523. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

For a simple nonrelativistic fermion model it is shown that the Schwinger anomaly can be viewed as an effect of the infinite depth of the Dirac sea. 4 refs.

49971 (JINR-E-4-89-19) **Two new types of solvability of the one-dimensional anharmonic oscillators.** Znojil, M. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1989. 9p. Order Number DE91600524. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

In the Schroedinger picture, we propose a new modification of the so-called Hill-determinant technique. It is shown to guarantee a proper matching of the two underlying power series $\Psi(x)$ at x=0. In the Heisenberg picture, an evolution of the same one-dimensional polynomially anharmonic oscillator is considered. A modified Peano-Baker method is applied and shown to define the explicit solutions by recurrences. 11 refs.

49972 (JINR-R-2-88-940) **On a generalization of the gauge principle at high energies.** Kadyshevskij, V.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics); Fursaev, D.V. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1988. 14p. (In Russian). Order Number DE91600525. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Submitted to Teor. Mat. Fiz.

The model of the Euclidean gauge theory is constructed for the system of interacting scalar and vector fields which is based on a generalized concept of the field itself in the region of high energies. The key role is played by the momentum Lobachevsky four-space with the curvature radius M as a new physical constant (fundamental mass). As a Fourier transform we use the expansion over unitary representations of the group of motions of the Lobachevsky p-space. Upon going to the corresponding new configurational representation the basic equations of the theory become differential-difference ones with the step $\approx 1/M$. In this representation, local gauge transformations of material and vector fields are defined. Due to the presence of the fundamental mass M in the theory, the gauge transformation law of the vector field turns out to be essentially modified and is a combination of the standard Yang-Mills transformations and gauge vector field transformations specific of the theory on the lattice. However, the latter does not break the Euclidean O(4) invariance of the model. In the low-energy approximation ($M \to \infty$) this theory is equivalent to the standard one. 17 refs.

49973 (KEK-89-22, pp. 179-189) **Scattering amplitude of string on orbifold.** Nima, Shuji (Kyushu Univ., Fukuoka (Japan). Faculty of Science). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (In Japanese). (CONF-8911199-: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

The report discusses the scattering amplitude of closed bosonic strings on an orbifold as calculated by means of the Polyakov's path integral, and provides a general form of a classical solution required for the calculation. An equation is given for the boundary condition for closed bosonic strings on an orbifold. Several strings that are consistent with a boundary condition corresponding to the elements of a group G exist on the orbifold. An effective way of calculating the scattering amplitude of these strings is to use the Polyakov's path integral. This is considered useful for the calculation because it permits a geometric approach and does not need to rely on the Hilbert space. The basic approach is described first, and it is shown that a classical solution consistent with a certain boundary condition has to be identified to permit the calculation of the scattering amplitude of strings on the orbifold by means of the Polyakov's path integral. Then, the calculation process is discussed in relation to the extension of the world sheet, the form of the classical solution, and characteristics of a key parameter. (N.K.).

49974 (KEK-89-22, pp. 305-321) **Topological quantum field theories in higher dimensions.** Oda, Ichiro (Chiba Univ. (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199-: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

Horowitz and Srednicki have recently shown that the two-point function of the topological quantum field theory of Schwarz produces the linking number of two surfaces of dimension p and n-p-1 in an n dimensional manifold. Their derivation method for the linking number is heavily based on the Hodge theorem and some results of the eigenform of the Laplacian. The present study rederive their results in the abelian case and extends them to the nonabelian case by making use of a variational method based on the properties of a topological quantum field theory. Actually, the variational method has already proved to be useful for direct derivation of link invariants in three dimensions without relying on the two-dimensional conformal field theory. By this direct proof, one could have clear understanding of the equivalence between the three-dimensional Chern-Simons action and link polynomials. The variational method is briefly outlined, and some comments are made on difference between the above variational method and the one proposed here. (N.K.).

49975 (KEK-89-22, pp. 377-382) **'String amplitudes': What can we do about the divergent integrals?.** Amano, Kaoru (Tokyo Inst. of Tech. (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199-: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

The rules for perturbative construction of scattering amplitude constitute the most well-established part of the string theory. They lead to neat integral expressions that represent the amplitude as the sum over the geometry of the string world sheet. However, if one really tries to evaluate the expression, one has to go a long way from there, for the integral does not represent the amplitude in any direct way. The present report focuses on this problem. A study is made to show that the traditional integrals purporting to be string amplitudes are divergent and to identify a remedy. Obviously, any divergent amplitude is not acceptable in a case like the one-loop four-point amplitude. Although the origin of the divergences seems to relate to physical singularities, the integral fails to give imaginary part required for unitarity but only gives infinities which are not desired. Respecting the observation that the integral representation corresponds to the Euclidean Feynman integral, one may modify the integral by postulating an offshell integral for a certain Euclidean, then continuing the function analytically, and defining the physical amplitude by the limit value of the function. This would take one to the correct Minkowskian expression. Some examples are also shown. (N.K.).

49976 (KIFVE-88-08, pp. 39-44) **Quantum corrections to kink-type classical solution in one-dimensional phi 4 model.** Agasyan, N.O. (Moskovskij Gosudarstvennyj Univ., Moscow (USSR)); Akhmetov, E.A.; Kozhamkulov, T.A. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. (In Russian). In *Proceedings of the seminar of young scientists HEPI AN Kaz SSR. Part 1: 1. High energy physics and computer technique.* Order Number DE90706215. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Quantum corrections to the classical soliton solution of the kink type in a one-dimensional model are determined in the paper. Quantization is carried out by the method of functional intergration. Scheme of zero mode selection is presented.

49977 (MPI-PAE/Exp.El.-226) **Limits on compositeness of quarks and leptons from e^+e^- annihilation.** Kroha, H. CELLO Collaboration. Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik. Jun 1990. 7p. (CONF-900183-: Recontres De Moriond '90: new and exotic phenomena, Les Arcs (France), 20-27 Jan 1990). Source: Available from Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik.

Data of the CELLO experiment on pair production of electrons, muons, taus, and heavy quarks have been investigated in terms of compositeness. CELLO has performed simultaneous measurements of the differential cross sections for canti c and banti b production in e^+e^- annihilation. Different methods are compared for treating the common normalization errors of the data points when fitting the predicted cross sections. We discuss difficulties in the interpretation of experimental limits on the compositeness scale Λ not mentioned in previous measurements. Λ turns out not to be the appropriate parameter to estimate effects of a possible substructure of quarks and leptons. Limits on Λ from different experiments can neither be compared nor combined with each other. Therefore an analysis of the combined data on fermion pair production from PEP and PETRA has been performed. (orig.).

65 PHYSICS II

6510 Nuclear Physics

Refer also to citation(s) 48624, 50042, 50046

49978 (BNL–44911) **Proceedings of the workshop on heavy ion physics at the Alternating Gradient Synchrotron (AGS).** Hansen, O. (ed.). Brookhaven National Lab., Upton, NY (USA). [1990]. 512p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900331–: Workshop on heavy ion physics at the alternating gradient synchrotron (HIPAGS), Upton, NY (USA), 3-7 Mar 1990). Order Number DE90017639. Source: NTIS, PC A22/MF A01; OSTI; INIS; GPO Dep.

The Workshop in Heavy Ion Physics at the Alternating Gradient Synchrotron (HIPAGS) was held at Brookhaven from March 5 to 7, 2–1/2 days. The purpose was first to demonstrate the status of the experimental program of nucleus-nucleus collisions which started in the fall of 1986 with the first ^{16}O beam at 14.6 GeV/c per nucleon. The second objective was to present the theoretical concepts and models being applied to interpret the data. The program also included surveys of the results from the heavy ion program at the CERN-SPS, in areas that are relevant for the AGS program and discussions of future directions. The specific perspective at Brookhaven is the availability of Au beams at 11.5 GeV/c per nucleon from 1992, to which allusions were made so many times during the workshop. These proceedings are organized in the same way as the workshop program, so the list of papers is identical to the program. The workshop was very informal and very preliminary results were shown by experimentalists and theorists alike. Therefore it is strongly advised that anybody who quotes results or ideas from these proceedings, first consult with the authors of the paper being quoted. To facilitate that process, electronic mailing addresses (BITNET) are included with the list of papers and authors.

49979 (CONF-900601–8) **Nucleon parton distributions and nuclear structure.** Geesaman, D.F. Argonne National Lab., IL (USA). [1990]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 12. international conference on particles and nuclei; Cambridge, MA (USA); 24-29 Jun 1990. Order Number DE90017807. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The current experimental status of measurements of nucleon structure functions in deep inelastic lepton scattering is presented. Recent BCDMS and SLAC results provide a consistent data set for charged lepton scattering. New probes of parton distributions: direct photons, Drell Yan di-muon production, W, Z and heavy quark production are providing information on the gluon an antiquark distributions. The implications of these data on our understanding of the structure of the nucleon, and the structure of the nucleon in the nucleus are discussed. 26 refs., 9 figs.

49980 (CONF-900814–13) **Microscopic integral cross section measurements in the Be(d,n) neutron spectrum for applications in neutron dosimetry, radiation damage and the production of long-lived radionuclides.** Smith, D.L.; Meadows, J.W.; Greenwood, L.R. Argonne National Lab., IL (USA). [1990]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31-109-ENG-38. From 7. ASTM-EURATOM symposium on reactor dosimetry; Strasbourg (France); 27-31 Aug 1990. Order Number DE90017857. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Integral neutron-reaction cross sections have been measured, relative to the U-238 neutron fission cross-section standard, for 27 reactions which are of contemporary interest in various nuclear applications (e.g., fast-neutron dosimetry, neutron radiation damage and the production of long-lived activities which affect nuclear waste disposal). The neutron radiation field employed in this study was produced by bombarding a thick Be-metal target with 7-MeV deuterons from an accelerator. The experimental results are reported along with detailed information on the associated measurement uncertainties and their correlations. These data are also compared with corresponding calculated values, based on contemporary knowledge of the differential cross sections and of the Be(d,n) neutron spectrum. Some conclusions are reached on the utility of this procedure for neutron-reaction data testing.

49981 (FEI–1917) **Nuclear reaction cross sections recommended as the standards for neutron measurements.** Bychkov, V.M.; Kornilov, N.V.; Pashchenko, A.B.; Skripova, M.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst. 1988. 43p. (In Russian). Order Number DE91601229. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Cross sections and recommendations of International Committee on Nuclear Data for reactions used as standards during neutron measurements are presented. A new commentary based on discussions of problems of standard data at the conferences of 1982 in Smolenitsa and 1984 in Hill, is prepared. Recent information concerning the spectrum of Cf-252 spontaneous fission instant neutrons, presented at the conference in Leningrad in 1986 is presented. 33 refs.; 10 figs.

49982 (FRCEA-TH–288) **Charged pion production in nucleus-nucleus collisions AT E/A between 400 and 800 MeV.** Cavata, C. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Moyenne Energie; Paris-11 Univ., 91 - Orsay (France). Nov 1989. 242p. (In French). Order Number DE91702152. Source: NTIS (US Sales Only), PC A11/MF A01.

This thesis is devoted to the experimental study of pion production in relativistic heavy ions collisions. The first two chapters introduce the basic concepts and offer a review of the currently used theoretical models. The data presented were taken at the SATURNE accelerator with the DIOGENE detector. The last part is totally devoted to our results. The data analysis is described, with an emphasis on the impact parameter selection. The pion multiplicity is systematically studied as concerns its various aspects and implications. The impact parameter, beam energy and system size dependence are presented and compared with the results of intranuclear cascade calculation. The possibility of determining the nuclear equation of state from this comparison is discussed. The pion multiplicity distribution is consistent with a Poisson law which rules out any coherent pion production mechanism. The double differential cross-sections are then presented for large and small impact parameters. The question of pion origin in heavy ion collisions is discussed by tagging the on nucleus-nucleus inelastic collision process and the delta resonance contribution. Finally, a systematic study of pion flow is given along with a possible explanation by pion absorption in nuclear matter.

49983 (IAEA-NDS–51(Rev.2)) **JENDL fission product nuclear data libraries: Contents and documentation.** Lemmel, H.D. International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section. Jun 1989. 6p. Order Number DE91601233. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The Japanese fission-product data libraries are summarized, including the f.p. cross-section data library, the f.p. decay data library, and the f.p. decay and yield data library. All three are available free of charge, from the IAEA Nuclear Data Section. (author).

49984 (IAEA-NDS–90(Rev.2)) **BROND: USSR Evaluated Neutron Data Library.** Manokhin, V.N. (and others); Lemmel, H.D.; McLaughlin, P.K. International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section. Oct 1989. 16p. Order

Number DE91601234. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

BROND, the USSR computerized data library for evaluated neutron reaction data was released in 1987/1989. Upon request it is available on magnetic tape, costfree, from the IAEA Nuclear Data Section. This document describes the contents of this library in the versions BROND-NDS1 and BROND-NDS2. (author). 16 refs.

49985 (IAEA-NDS–96(Rev.0)) **ACTIV87 Fast neutron activation cross section file 1987.** Manokhin, V.N.; Pashchenko, A.B.; Plyaskin, V.I.; Bychkov, V.M.; Pronyaev, V.G. (comps.); Schwerer, O. (ed.). International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section. Oct 1989. 16p. Order Number DE91601235. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

This document summarizes the content of the Fast Neutron Activation Cross Section File based on data from different evaluated data libraries and individual evaluations in ENDF/B-5 format. The entire file or selective retrievals from it are available on magnetic tape, free of charge, from the IAEA Nuclear Data Section. (author).

49986 (IAEA-NDS–114(Rev.0)) **"ACTV-F/H" Neutron activation cross-section library for fusion reactor design: Data from the Hanford REAC*2 Data Library.** Goulo, V.G. International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section. Dec 1989. 75p. Order Number DE91601230. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

This library contains 284 neutron reaction or capture cross sections for 58 nuclides important for fusion reactor design for neutron energies up to 20 MeV. The data are in ENDF-6 format. The library is available on magnetic tape or diskette from the IAEA Nuclear Data Section, costfree upon request. (author).

49987 (IAEA-NDS–116(Rev.0)) **Thermal-neutron capture gamma-rays.** Tuli, J.K. (Brookhaven National Lab., Upton, NY (USA)); Lemmel, H.D. (ed.). International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section. Apr 1989. 2p. Order Number DE91601232. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

This document describes format and contents of a nuclear data library on magnetic tape which lists prompt gamma-rays from thermal-neutron capture evaluated by J.K. Tuli in 1982 and updated in 1988. The magnetic tape is available, costfree, from the IAEA Nuclear Data Section. (author).

49988 (ITEF–138-88) **Cumulative K^--meson production by protons with energy of 10 GeV.** Boyarinov, S.V. (and others); Gerzon, S.A.; Evseev, I.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1988. 16p. (In Russian). Order Number DE91601237. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The data on the yields of K^- mesons with 0.6-1.6 GeV/c momenta at the angle of 119 deg in laboratory system in pA→K^-X reactions on beryllium, aluminium, copper, tantalum, are presented. Invariant production cross sections of cumulative K^- mesons, the dependence of these cross sections on kinetic energy of K^-, are measured. The values of K^- spectrum slope parameters and the dependence of slope parameters on the mass number are given. 7 refs.; 10 figs.

49989 (IYF–88-01/A) **Cross sections of scattering of ^{3}He ions and α-particles with 12-20 MeV/nucleon energy on the light nuclei.** Burtebaev, N.T.; Dujsebaev, A.D.; Ivanov, G.N.; Kanashevich, V.I. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Yadernoj Fiziki. 1988. 53p. (In Russian). Order Number DE91601238. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

The paper presents tabulated experimental differential cross-sections of scattering of ^{3}He ions and αparticles with 50-60 MeV energy on ^{4}He, ^{6}Li, ^{7}Li, ^{9}Be, ^{12}C, ^{13}C, ^{14}N, ^{16}O, ^{20}Ne, ^{24}Mg, ^{28}Si nuclei in 10-170 deg angle range in laboratory coordinate system. A brief characteristics of the experiment is given as well as optimal parameters of optic potentials. 10 refs.; 27 tabs.

49990 (IYF–88-03) **Detection and experimental investigation of α-particle Wolf-Bragg scattering on quasicrystalline atomic nuclei.** Yushkov, A.V. (and others); Kuterbekov, K.A.; Pavlova, N.N. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Yadernoj Fiziki. 1988. 29p. (In Russian). Order Number DE91601239. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Precision measurements of angular distributions of differential cross sections of inelastic scattering of α-particles on light and medium nuclej with excitation of collective level 2^+ are carried out. A microstructure detected before of angular distributions of differential cross sections is confirmed by the authors. A full-scale analysis of literature data is carried out to detect the effect above mentioned. The microstructure of angular distributions of differential cross sections is interpreted as the volf-Bragg scattering unknown before on the internuclear quasicrystalline lattice formed by α-clusters in light nuclei and by nucleons - in medium one.

49991 (JINR-E–7-89-126) **Neutron-rich isotopes of the lightest elements.** Oganesyan, Yu.Ts.; Penionzhkevich, Yu.Eh.; Kalpakchieva, R. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions. 1989. 12p. Order Number DE91601240. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Submitted to Intern. school on Nucl. Phys., Brashov, Romania, 1988.

A review is presented of the experimental investigations on the stability of very neutron-rich light nuclei carried out at the JINR Laboratory of Nuclear Reactions. Results on mass excess measurements are reported for ^{4}H, ^{5}H, ^{6}H, ^{7}H and for the superheavy helium isotope ^{9}He. Some results from the joint JINR-Ganil experiment on the search for and study of new neutron-rich light nuclei are also given. Analyzed are new possibilities for the investigation of multineutron decay of light nuclei. 14 refs.; 10 figs.

49992 (KIFVE–88-16) **Study of multiparticle correlations in 200-400 GeV range.** Boos, E.G.; Zastrozhnova, N.N.; Kholmetskaya, A.V.; Yakobi, V.V. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. 20p. (In Russian). Order Number DE91601241. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Azimuthal correlations at individual events in pp- and pA-interactions at E_0=200 and 400 GeV are analysed on the basis of the photoemulsion technology. Single-jet events in two-dimensional planes: mean quasi-rapidity-standard deviation and medium azimuthal angle-standard deviation are detected. It is shown that average multiplicities of single-jet events is considerably less (approximately two-four times) than the average multiplicity of all interactions and they don't depend on the type of the target nucleus. The investigation of events accompanied by full destruction of hevy ions (Ag, Br) has shown isotropic distribution of azimuthal angles of shower particles. It is a new factor in favour of the fact that multiple production of particles in events, accompanying by their full destruction, is of another character in comparison with the production process in an elementary act and in interactions of light and heavy ions. 15 refs.; 3 tabs.; 3 figs.

49993 (LA-UR–90-2055) **General purpose nuclear data evaluations for ENDF/B-VI: Impact of cross-section standards.** Young, P.G. Los Alamos National Lab., NM (USA). [1990]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-901101–15: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE90013168. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Over the past year the Cross Section Evaluation Working Group (CSEWG) has finalized and issued new evaluations for over 70 nuclides in Version 6 of ENDF/B. These data provide the foundation for a new series of reactor benchmark calculations. An integral part of the evaluation effort for ENDF/B-VI has been the most ambitious effort ever undertaken to systematically and simultaneously reevaluate the cross sections used for neutron standards. While a number of the materials and reactions identified as standards are directly involved in fission reactor calculations, the impact of the standards data is felt far beyond the specific standards reactions. The effect of the Version 6 standards data file on several evaluations of data of interest for fission reactors is discussed in this paper, together with the methodology used to utilize the standards.

49994 (LA-UR–90-2212) **Fission-product chain yields and delayed neutrons: ANS 5.2 and ANS 5.8.** England, T.R. (Los

Alamos National Lab., NM (USA)); Rider, B.F.; Brady, M.C. Los Alamos National Lab., NM (USA). [1990]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-901101--23: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE90015104. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Short communication. DELAYED NEUTRONS/nuclear data collections; FISSION YIELD/nuclear data collections; URANIUM 235

6511 Experimental Techniques

49995 (IPNO-DRE-89-21) **Experiments on neutron-rich light nuclei at Ganil.** Mueller, A.C. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1989. 7p. (CONF-8906160--:). Order Number DE91700538. Source: NTIS (US Sales Only), PC A02/MF A01.

Some experimental results on neutron-rich isotopes, at Ganil, are discussed. Using ^{48}Ca to study the distributions of projectile - like fragments at intermediate energy, the identification of fragment nuclei is carried out. The half life measurements of unexplored neutron rich nuclei, applying the coincidence observation of delayed neutrons with beta rays and ^{48}Ca beam, at low counting statistics are performed. The results of the direct mass measurement are presented. The comparison of the masses of the oxygen isotopes up to the last neutron stable ^{24}O with theoretical predictions are carried out. The data on radii determination of Be and Li isotopes, obtained at Ganil, is given.

6512 Nuclear Properties and Reactions, A = 1-5, Experimental

Refer also to citation(s) 50034

49996 (INS-823) **Real-pion states formed by virtual-pion beam: New family of nuclear excited states.** Yamazaki, Toshimitsu. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Apr 1990. 26p. Order Number DE90520258. Source: NTIS (US Sales Only), PC A03/MF A01.

Deeply bound pionic states are discussed from various points of view; highly excited nuclear states as a cluster family of pionic bound states, Σ atom/Σ hypernuclei, halo-like density distributions, virtual pion beam to produce pionic states, etc. (author).

49997 (ITEF-96-89) **Cumulative nucleon production in ^{3}Hep- and ^{3}Hp interactions at momenta of colliding nuclei 5 GeV/c.** Abdullin, S.K. (and others); Blinov, A.V.; Vanyushin, I.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1989. 20p. (In Russian). Order Number DE91601248. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Inclusive cross sections of cumulative protons produced in ^{3}Hep- and ^{3}Hp-interactions under momenta of colliding 5 GeV/c nuclei are investigated. Experimental material is obtained using liquid-hydrogen ITEP chamber-80cm. Under the cumulative proton kinetic energy, exceeding 50 MeV inclusive cross section ratio $\sigma(^3\text{Hep}\rightarrow\text{pX})/\sigma(^3\text{Hp}\rightarrow\text{pX})=1.6\pm0.1$. Within the same energy interval evaluation of yield ratio of cumulative protons and neutrons, produced in ^{3}Hep -interactions, leads to $\approx$ 1.6 value. Asymmetry of mean multiple protons escaping forward and backward both in ^{3}Hep -and in ^{3}Hp interactions is observed. Averaged invariant distribution functions for cumulative protons and neutrons in ^{3}Hep-interactions and protons in ^{3}Hp-interactions are constructed (the averaging is performed within 90-180 deg and 120-180 deg intervals). To temperatures of such distributions are found. 43 refs.; 1 fig.

6513 Nuclear Properties and Reactions, A = 6-19, Experimental

Refer also to citation(s) 50036, 50072

49998 (FRCEA-TH-292) **Study of the linear momentum transfer distribution in the ^{40} Ar + ^{12}C system at 27, 32, 36, 40, 44 and 60 MeV/A.** Heuer, D. CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale; Grenoble-1 Univ., 38 (France). Jul 1988. 97p. (In French). Order Number DE91702093. Source: NTIS (US Sales Only), PC A05/MF A01.

This work is devoted to the study of hot nuclei and especially to the difficulties encountered in reaching high excitation energies. It is first shown how data processing techniques can be considerably improved in order to handle more and more complex experimental data, then an analysis of the ^{40} Ar + ^{12}C reaction in reverse kinematics at incident energies ranging from 27 to 60 MeV/A is performed. Very phenomenological in a first step, this study then refers to partial fusion models and finally gives a comparison of the experimental data with the results of a code based on the Landau-Vlasov equations. This work enhances the inefficiency of the reaction mechanism to heat up nuclear matter.

49999 (INDC(CCP)-313) **Neutron cross-section evaluation for ^{15}N.** Badikov, S.A.; Blokhin, A.I.; Buleeva, N.N.; Gusejnov, A.G.; Masterov, V.S.; Pronyaev, V.G.; Rabotnov, N.S.; Titarenko, N.N. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. May 1990. 13p. Translated from Yadernye Konstanty (Nuclear Constants) 2, 1989. Russian original distributed as INDC(CCP)-303/G. Order Number DE91601252. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Translated from Yadernye Konstanty (Nuclear Constants) 2, 1989. Russian original distributed as INDC(CCP)-303/G.

Few experimental data are available on ^{15}N neutron cross-sections. The evaluation of the total neutron cross-section in the resonance region given in this paper is based on the most detailed and accurate available data. 16 refs, 4 figs, 2 tabs.

50000 (LA-UR-90-3255) **Cross section and analyzing power for quasifree (p,n) reactions.** Taddeucci, T.N. (Los Alamos National Lab., NM (USA)); Byrd, R.C.; Carey, T.A.; McClelland, J.B.; Rybarcyk, L.J.; Sailor, W.C.; Ciskowski, D.E.; Goodman, C.D.; Huang, W.; Gulmez, E.; Marchlenski, D.; Sugarbaker, E.; Prout, D.; Rapaport, J. Los Alamos National Lab., NM (USA). [1990]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-900601--11: 12. international conference on particles and nuclei, Cambridge, MA (USA), 24-29 Jun 1990). Order Number DE91000214. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Cross sections and analyzing powers have been measured for ^{12}C(p,n) at 494 MeV and 795 MeV and for Pb(p,n) at 795 MeV. The data span an energy loss range of at least 200 MeV, which is sufficient to clearly reveal the large peak associated with quasifree neutron knockout. The kinematics, cross section, and analyzing power for this peak are compared to the corresponding observables for free nucleon-nucleon scattering and to the observables calculated with a relativistic Fermi-gas model. 15 refs., 3 figs.

50001 (LBL-29361) **Complex fragment emission in binary and multifragment decay of very hot nuclear systems.** Moretto, L.G.; Blumenfeld, Y.; Delis, D.; Wozniak, G.J. Lawrence Berkeley Lab., CA (USA). Jul 1990. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-9005257--1: International school on nuclear physics, Kiev (USSR), 28 May - 8 jun 1990). Order Number DE91000180. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Low-energy compound nucleus emission of complex fragments in the reaction ^{63}Cu + ^{12}C is used to infer the associated ridge-line potential. Compound binary emission of complex fragments at higher energies is illustrated for a variety of reactions. Complex fragment emission from 35 and 40 MeV/N ^{139}La + ^{12}C, ^{27}Al, ^{40}Ca and ^{51}V reactions has been studied. Multifragment events from these reactions were assigned to sources characterized by their energy and mass through the incomplete-fusion-model kinematics. Excitation functions for the various multifragment channels appear to be nearly independent of the system and bombarding energy. Preliminary comparisons of the data with sequential-statistical-decay calculations are discussed.

6514 Nuclear Properties and Reactions, A = 20-38, Experimental

Refer also to citation(s) 50001

50002 (CENBG–8937) **Beta decay of ^{22}O.** Hubert, F. (Bordeaux-1 Univ., 33 - Gradignan (FR) Centre d'Etudes Nucleaires); Dufour, J.P.; Del Moral, R.; Fleury, A.; Jean, D.; Pravikoff, M.S.; Delagrange, H.; Geissel, H.; Schmidt, K.H.; Hanelt, E. Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires. 1989. 7p. (CONF-8911216–:). Order Number DE91702104. Source: NTIS (US Sales Only), PC A02/MF A01.

The study of light nuclei far from stability has been recently renewed by the possibility of production through the projectile fragmentation of intermediate energy heavy ion beams at GANIL. The results presented here have been obtained with the Projectile Fragments Isotopic Separation method developed at the LISE spectrometer. ^{22}O is a Tz = 3 nucleus and is the first in a series of seven such nuclei in the sd shell extending from ^{22}O to ^{24}Mg. Although the half life of ^{22}O was previously measured by Murphy et al., the present study is the first beta-gamma spectroscopy on this neutron rich nucleus. Five gamma lines have been attributed to the β decay of ^{22}O with a measured half life of T = (2.25±0.15)s and a partial decay scheme has been established.

50003 (CENBG–8938) **Search for β-^{2} He, β - p α and β - ^{3}p in the proton-rich nucleus ^{31}Ar.** Bazin, D. (Bordeaux-1 Univ., 33 - Gradignan (FR). Centre d'Etudes Nucleaires); Dufour, J.P.; Fleury, A.; Hubert, F.; Del Moral, R.; Pravikoff, M.S.; Anne, R.; Bricault, P.; Detraz, C.; Lewitowicz, M.; Zhang, Y.; Guillemaud-Mueller, D.; Jacmart, J.C.; MuellBordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires. 1989. 13p. (CONF-8911216–:). Order Number DE91702103. Source: NTIS (US Sales Only), PC A03/MF A01.

The allowed decay modes of ^{31} Ar from the isobaric analog state of ^{31} Cl are investigated by means of a new silicon detector telescope. The data recorded by this detector are compared to Monte-Carlo simulations, and lead to the observation of β-delayed 2 protons emission with no indication of a β-^{2} He process, and to strong evidences of β -delayed 3 protons radioactivity observed here for the first time. None of the others possible decay modes (β-p, β-α and β-pα) is observed.

50004 (INS–818) **Nucleosynthesis in the rapid-proton process.** Kubono, S. (and others); Funatsu, Y.; Ikeda, N. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Apr 1990. 10p. Order Number DE90520225. Source: NTIS (US Sales Only), PC A02/MF A01.

Recent experimental studies on ^{20}Na and ^{21}Mg and the implication to the onset of the rapid-proton process in stellar sites are discussed. A plan of the nuclear reaction studies with using radioactive nuclear beams is also presented. (author).

50005 (JINR–2-35-89, pp. 47-56) **Investigation of the particle stability of the isotope ^{26}O in the nuclear reactions 44 MeV/A ^{48}Ca+Ta.** Guillemaud-Mueller, D. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Anne, R.; Bazin, D. Joint Inst. for Nuclear Research, Dubna (USSR); Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions. 1989. In *JINR rapid communications: Collection.* Order Number DE90706214. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

An attempt has been made to synthesize the extremely neutron-rich isotope ^{26}O in the nuclear reaction 44 MeV/A ^{48}Ca+Ta. Use was made of magnetic separation and identification methods including time-of-flight and ΔE,E measurements. With a sensitivity one order of magnitude higher than that predicted from the extrapolated yields no events attributable to the ^{26}O nucleus have been observed. Theoretical analysis of the problem of the particle stability of ^{26,28}O is being made. 37 refs.; 3 figs.; 2 tabs.

50006 (LYCEN–89-02 S.6.1) **Isotopical separation of relativistic projectile fragments, first experiments at SATURNE.** Gaimard, J.J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (DE)); Blank, B.; Geissel, H.; Muenzenberg, G.; Schmidt, K.H.; Stelzer, H.; Suemmerer, K.; Clerc, H.G.; Hanelt, E.; Voss, B.; Bazin, D.; Del Moral, R.; Dufour, J.P.; Fleury, A.; PravikLyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

Short note. SATURNE/argon 40 beams; SATURNE/gev range 10-100; ARGON 40 BEAMS/nuclear fragments; NUCLEAR FRAGMENTS/isotope separation; SATURNE; ENERGY LOSSES; PHOSPHORUS 36; SULFUR 32

6515 Nuclear Properties and Reactions, A = 39-58, Experimental

Refer also to citation(s) 49996, 50001, 50006

50007 (CEA-N–2629) **Charged pion production in nucleus-nucleus collisions at E/A between 400 and 800 mev.** Cavata, C. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire; Paris-11 Univ., 91 - Orsay (France). Feb 1990. 250p. (In French). Order Number DE91702081. Source: NTIS (US Sales Only), PC A11/MF A01.

This thesis is devoted to the experimental study of pion production in relativistic heavy ions collisions. The first two chapters introduce the basic concepts and offer a review of the currently used theoretical models. The data presented were taken at the SATURNE accelerator with the DIOGENE detector (chapter III). The last part is totally devoted to our results. The data analysis is described, with an emphasis on the impact parameter selection. The pion multiplicity is systematically studied as concerns its various aspects and implications. The impact parameter, beam energy and system size dependence are presented and compared with the results of intranuclear cascade calculation. The possibility of determining the nuclear equation of state from this comparison is discussed. The pion multiplicity distribution is consistent with a Poisson law which rules out any coherent pion production mechanism. The double differential cross-sections are then presented for large and small impact parameters. The question of pion origin in heavy ion collisions is discussed by tagging the one nucleus-nucleus inelastic collision process and the delta resonance contribution. Finally, a systematic study of pion flow is given along with a possible explanation by pion absorption in nuclear matter.

50008 (FRNC-R–322) **Level density parameter of nuclei at finite temperature.** Gregoire, C. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (FR)); Kuo, T.T.S.; Stout, D.B. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). Nov 1989. 22p. US DOE Grant DE-FG02-88ER40388. Order Number DE91702099. Source: NTIS (US Sales Only), PC A03/MF A01.

The contribution of particle-particle (hole-hole) and of particle-hole ring diagrams to the nuclear level density parameter at finite temperature is calculated. We first derive the correlated grand potential with the above ring diagrams included to all orders by way of a finite temperature RPA equation. An expression for the correlated level density parameter is then obtained by differentiating the grand potential. Results obtained for the ^{40}Ca nucleus with realistic matrix elements derived from the Paris potential are presented. The contribution of the RPA correlations is found to be important, being significantly larger than typical Hartree-Fock results. The temperature dependence of the level density parameter derived in the present work is generally similar to that obtained in a schematic model. Comparison with available experimental data is discussed.

50009 (INDC(CCP)–312) **Consistency of microscopic evaluations and integral experiments for chromium, iron and nickel.** Blokhin, A.I.; Golubev, V.I.; Ignatyuk, A.V.; Nikolaev, M.N.; Pronyaev, V.G.; Tsibulya, A.M. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. May 1990. 10p. Translated from Yadernye Konstanty (Nuclear Constants) 2, 1989. Russian original distributed as INDC(CCP)-303/G. Order Number DE91601267. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Translated from Yadernye Konstanty (Nuclear Constants) 2, 1989. Russian original distributed as INDC(CCP)-303/G.

In this paper we consider the characteristics of the evaluated data files of neutron cross-sections for natural isotopic mixtures of chromium, iron and nickel which have an important role in neutron physics calculations for fast reactors and fusion reactors. 12 refs, 1 fig., 1 tab.

6516 Nuclear Properties and Reactions, A = 59-89, Experimental

Refer also to citation(s) 50009

50010 (JINR–2-35-89, pp. 11-14) **Investigation of anomalous pion production in the reaction Cu(p,π^+)X by 350 MeV protons.** Akimov, Yu.K. (and others); Gostkin, M.I.; Gajsak, I.I. Joint Inst. for Nuclear Research, Dubna (USSR); Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems. 1989. In *JINR rapid communications: Collection.* Order Number DE90706214. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

The narrow structure in the energy dependence of the charged pion yields generated by protons on the copper nucleus at 90 deg in the laboratory frame was investigated. A new upper limit of the structure width (FWHM) $\Delta T_p \leq 5$ MeV in the incident proton energy is obtained. For the first time the manifestation of the structure is observed at 115 and 125 deg angles in the laboratory frame on the same nucleus. 9 refs.; 2 figs.

6517 Nuclear Properties and Reactions, A = 90-149, Experimental

Refer also to citation(s) 50007, 50014

6518 Nuclear Properties and Reactions, A = 150-189, Experimental

Refer also to citation(s) 50073

50011 (CONF-900450–11) **Population of superdeformed bands, the competition with fission, and the barrier between normal and superdeformed states.** Khoo, T.L. (Argonne National Lab., IL (USA)); Janssens, R.V.F.; Moore, E.F.; Ahmad, I.; Carpenter, M.P.; Chasman, R.R.; Wolfs, F.L.H.; Beard, K.B.; Garg, U.; Ye, D.; Benet, P.; Daly, P.J.; Grabowski, Z.W.; Drigert, M.W. Argonne National Lab., IL (USA). [1990]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Nuclear structure in the '90's; Oak Ridge, TN (USA); 23-27 Apr 1990. Order Number DE90017666. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

In this paper we report on the entry points leading to superdeformed (SD) as well as normal bands. We find that, compared to normal bands, the entry spins for the SD bands are about 9 $\hbar$ higher, and the entry excitation energy 1–3 MeV colder. We also conclude that population of the SD bands represents successful competition against fission. SD bands in both the Dy and Hg regions are considered.

50012 (GANIL-P–8921) **Central collisions at the fermi energy.** Harar, S. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). 1989. 11p. (CONF-8910237–: International school seminar on heavy ion physics, Dubna (USSR), 3-12 Oct 1989). Order Number DE91702098. Source: NTIS (US Sales Only), PC A03/MF A01.

Heavy ion induced collisions at the Fermi energy open the opportunity to study equilibrated nuclear matter in extreme conditions of excitation energy, angular momentum, shape, etc... In this report, one will focus on the formation and decay properties of hot nuclei achieved at Ganil by using the fusion-fission process. Thus, the research program is centered on two main aspects. (1) Conditions which determine nuclear dynamics leading to the fusion of colliding ions. (2) Properties associated to the cooling mechanisms after the formation of hot nuclei.

6519 Nuclear Properties and Reactions, A = 190-219, Experimental

Refer also to citation(s) 49996, 50000, 50007, 50011, 50073

50013 (CEA-CONF–9955) **Shape isomers at no spin.** Bonche, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Service de Physique Theorique); Krieger, S.J.; Weiss, M.S.; Quentin, P.; Meyer, J.; Meyer, M. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique. 1989. 1p. (CONF-890826–: International nuclear physics and cosmology conference, Sao Paulo (Brazil), 20-26 Aug 1989). Order Number DE91702095. Source: NTIS (US Sales Only), PC A02/MF A01.

Short note. OSMIUM ISOTOPES/isomeric nuclei; PLATINUM ISOTOPES/isomeric nuclei; MERCURY ISOTOPES/isomeric nuclei; ISOMERIC NUCLEI/hartree-fock method; ISOMERIC NUCLEI/isomeric transitions; THREE-DIMENSIONAL CALCULATIONS

50014 (RCNP-P–108, pp. 151-157) **Gamma ray from highly excited ^{190}Hg and ^{110}Sn.** Iwata, Yousei (Hiroshima Univ. (Japan). Faculty of Science). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

The report briefly outlines some experiments with giant dipole resonance formed on highly excited ^{190}Hg or ^{110}Sn. A crystal ball is used to measure the spectrum of gamma rays from a highly excited Hg. This is performed in a recoil nucleus mass analyzer, and recoil nuclei and gamma rays are measured simultaneously. An appropriate excitation energy is selected so that three or four neutrons are emitted from the reaction $^{48}Ca+^{142}Nd \rightarrow ^{190}Hg^*$. The mass spectrum of the recoil nuclei is found to contain a broad peak associated with ^{188}Hg in addition to strong peaks due to ^{186}Hg and ^{187}Hg. Most of the residual ^{188}Hg nuclei result from 2n reactions. In this case, it can be assumed that the energy is absorbed by gamma rays instead of a neutron. The intensity associated with the 3n channels decreases exponentially and there is no evidence of gamma rays from giant dipole resonance. For ^{110}Sn, a study is made of the spectrum of gamma rays emitted from the reaction $^{40}Ar+^{70}Ge$. It is shown that the intensity of giant dipole resonance decreases with increasing temperature. It is also revealed that the width of the giant dipole resonance increases due to fluctuations in the shape of the nuclei. (N.K.).

6520 Nuclear Properties and Reactions, A = 220 and Above, Experimental

Refer also to citation(s) 50012

50015 (CEA-CONF–9976) **Hyperdeformed pear-shaped nuclei.** Blons, J.; Paya, D. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Basse Energie. 1989. 10p. (CONF-890686–: International conference on new aspects of nuclear spectroscopy, Crete (Greece), 25 Jun - 1 jul 1989). Order Number DE91702094. Source: NTIS (US Sales Only), PC A02/MF A01.

Several wells are found in the potential energy surface of the actinides. The first well corresponds to the ground state deformation ($\epsilon_2 \simeq 0.2$). The second well accomodates fission isomers with a larger deformation ($\epsilon_2 \simeq 0.6$). A third well is calculated to occur at the $\epsilon_2 \simeq 0.9$, $\epsilon_3 \pm 0.2$ quadrupole and octopole deformation, respectively. In this paper, we present experimental evidence for the existence of hyperdeformed pear-shaped thorium nuclei in this third well.

50016 (IAE–4869-2) **Low-energy conversion electrons from primary fragments of uranium 235 fission by thermal neutrons.** Guseva, E.V.; Pelekhov, V.I.; Sergeev, M.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 16p. (In Russian). Order Number DE91601302. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The conversion electron spectra from primary fragments of uranium-235 thermal fission, identified by mass and total kinetic energy, have been measured. An electron yield, higher than those observed earlier, from fragments with a postneutron mass of A=87-88 has been observed, which is due to unresolved group of sufficiently intense k-lines from gamma-transitions with energies of 43-52 keV much lower than the average one for fragments in this mass region ($E_\gamma \approx 850$ keV), known so far. Dependence of the intensity of a complex conversion peak 42.3 keV on the total kinetic energy of fragments in the spectra relating to the specified range

of conventional mass and normalized to the fragment yield in the chosen 10 MeV ranges of kinetic energy has also been found. 11 refs.; 9 figs.

50017 (JINR–2-35-89, pp. 43-46) **Detection of the radioactive decay of ^{236}Pu involving the emission of ^{26}Mg nuclei.** Ogloblin, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Venikov, N.I.; Tret'yakova, S.P. Joint Inst. for Nuclear Research, Dubna (USSR); Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions. 1989. (In Russian). In *JINR rapid communications: Collection.* Order Number DE90706214. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

Two events of ^{236}Pu decay accompanied by the emission of magnesium nuclei have been recorded by means of solid-state track detectors. The ratio between the probability of this channel and that of alpha decay is about $2x10^{-14}$. The partial half-life is about $1.5x10^{14}$ years. 15 refs.; 1 fig.; 1 tab.

6530 Nuclear Theory

Refer also to citation(s) 49836, 49925, 49978, 49983, 49984, 49985, 49995, 50008

50018 (BNL–45008) **Axial asymmetry and the IBM.** Casten, R.F. Brookhaven National Lab., Upton, NY (USA). [1990]. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9009135–1: International conference on high spin physics and gamma-soft nuclei, Pittsburgh, PA (USA), 17-21 Sep 1990). Order Number DE90017634. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The intimate relation between the IBM and axial asymmetry, appearing in its dynamical symmetries, in numerical calculations, in bandmixing effects, and in extensions to the model, is discussed.

50019 (BNL–45009) **The proton-neutron residual interaction in nuclear structure.** Casten, R.F. Brookhaven National Lab., Upton, NY (USA). [1990]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900912–3: 8. international conference on atomic masses and fundamental constants, Jerusalem (Israel), 9-14 Sep 1990). Order Number DE90017633. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Although the importance of the residual T = 0 proton-neutron (p-n) interaction in inducing single nucleon configuration mixing, nonspherical nuclear shapes, collectivity, and phase transitions have been known for nearly forty years, its widespread ramifications have become more fully appreciated only recently as a unified picture of the effects of the p-n interaction is emerging. A phenomenological approach that has proved useful is the N_pN_n scheme and the associated concept of the P factor. Empirical p-n matrix elements disclose intriguing microstructure which reveals much about the role of the p-n interaction and its different components.

50020 (BNL–45010) **Effects of the residual proton-neutron interaction in the development of collectivity in nuclei.** Casten, R.F. Brookhaven National Lab., Upton, NY (USA). [1990]. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9008152–1: Predeal international summer school recent advances in nuclear structure, Predeal (Romania), 31 Aug - 8 sep 1990). Order Number DE90017635. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The widespread effects of the residual T=0 proton-neutron (p-n) interaction in the evolution of nuclear structure are discussed. Although these effects in inducing single nucleon configuration mixing, and hence in the development of non-spherical nuclear shapes, collectivity, and the associated shape and phase transitions have been known for four decades, it is only in recent years that their deep ramifications have become more fully appreciated. This had led to a unified phenomenological understanding of the role of the p-n interaction in nuclear collectivity and to, for example, the proposal of the N_pN_n scheme and the associated concept of the P factor, which is a normalized value of N_pN_n reflecting the average number of p-n interactions per valence nucleon. Simultaneously, experimentally-determined p-n matrix elements for many nuclei have been extracted: they disclose striking anomalies for N=Z nuclei, and intriguing microstructure. These developments and empirical results will be discussed along with microscopic calculations that can be used to interpret them. 18 refs., 13 figs.

50021 (BNL–45011) **Empirical proton-neutron interaction energies and nuclear structure.** Brenner, D.S. (Clark Univ., Worcester, MA (USA)); Chou, W.T.; Casten, R.F.; Zhang, J.Y.; Wesselborg, C. Brookhaven National Lab., Upton, NY (USA). [1990]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016 ;FG02-88ER40417. (CONF-900912–2: 8. international conference on atomic masses and fundamental constants, Jerusalem (Israel), 9-14 Sep 1990). Order Number DE90017632. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Empirical proton-neutron (p-n) interaction energies are extracted for all even-even nuclei with well-known binding energies using a simple double difference equation. Three features are disclosed: a systematic decrease of p-n interaction strengths (excepting N=Z nuclei) with increasing A, large interaction strengths for N=Z nuclei, and microstructure in doubly magic and deformed regions. Shell model calculations are used to explain the behavior of N=Z and other nuclei in the sd shell. Arguments based on orbit occupancy are introduced to explain microstructure effects in heavier nuclei and are given quantitative support by simple microscopic Nilsson and Shell Model calculations. The analysis sheds light on the relative roles of monopole and quadrupole components of the p-n interaction in determining nuclear structure. 19 refs., 5 figs.

50022 (CONF-901057–1) **Superdeformation in the mercury region.** Chasman, R.R. Argonne National Lab., IL (USA). [1990]. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 7. international symposium on capture gamma-ray spectroscopy and related topics; Pacific Grove, CA (USA); 14-19 Oct 1990. Order Number DE90017810. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A brief history of superdeformation is presented. Calculations of superdeformed well depths, single particle energy level diagrams at I = 0, orbital alignments as a function of rotational frequency and dynamical moments of inertia are presented. The sensitivity of calculations to the details of the spin-orbit interaction are examined. Comparisons with experimental results are made. 37 refs., 9 figs.

50023 (CONF-9004209–7) **Some thoughts on opportunities with reactions using radioactive beams.** Schiffer, J.P. (Argonne National Lab.,. IL (USA)). Argonne National Lab., IL (USA). [1990]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Workshop on the science of intense radioactive ion beams; Los Alamos, NM (USA); 10-12 Apr 1990. Order Number DE90017805. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

I was asked to talk about the use of radioactive beams for nuclear reactions. My overall perspective is that the scientific justification for such studies must be done carefully. To go to the added complexity of radioactive beams one must clearly demonstrate the need for obtaining information about nuclear structure or processes, information that is not otherwise available. On the other hand, much of what we know about nuclear structure comes from nuclear reactions with stable nuclear beams and targets. While a certain amount of information about far from stability nuclei may be obtained from the study of their radioactive decays, this is limited. Our knowledge and understanding of nuclear structure comes from stable nuclei: energy levels, their spins and parties, and very importantly the matrix elements characterizing them. These are largely determined by reaction studies with normal stable nuclei. The extension of such studies to unstable nuclei, far from stability, may well hold qualitative surprises, or at the very least give a firmer basis to our understanding of nuclear structure. Perhaps it is a matter of taste, but if one wishes to start on this endeavor then it is best to begin with simple, easily accessible features. The "simplest" nuclei are the ones that form doubly-closed shells and the easiest features to explore initially are the single-particle states and the collective excitations that one can build on these. I would like to emphasize that a unique facility for this type of study is about to come into operation in Darmstadt where the ESR storage ring will

capture radioactive beams from fragmentation products and cool them to useful energies for reaction studies.

50024 (CONF-9007141–3) **Heavy ion transfer reactions: Status and prospects.** Betts, R.R. Argonne National Lab., IL (USA). [1990]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Workshop on heavy-ion collisions at energies near the Coulomb barrier; Daresbury (UK); 5-7 Jul 1990. Order Number DE90017692. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Some comments are addressed to the current status of and possible future directions for transfer reactions induced by heavy ions.

50025 (FEI–1958) **Collective bands in actinide nuclei and rare-earth elements in the SU(3) scheme.** Asherova, R.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Smirnov, Yu.F.; Filippov, G.F. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst. 1989. 22p. (In Russian). Order Number DE91601123. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Spectra of low collective states of Th,U,Pu nuclei and some rare-earth elements are calculated in a simple phenomenological model with the three-parametric effective Hamiltonian constructed from generators of the SU(3) group. The SU(3) diagram is shown to permit to describe well the structure of ground and γ bands and their electromagnetic properties. 22 refs.; 1 fig.; 4 tabs.

50026 (IAE–4761-2) **Resonating-group method in calculations of low-energy reactions and n^4He scattering with realistic NN interactions.** Ehfros, V.D. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 8p. (In Russian). Order Number DE91601158. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

A review of an effective algebraic version of resonating-group method (RGM) in reactions with lightest nuclei is given. The dependence of RGM results of reaction fragment wave function choice is considered. Restrictions of the method and results of the non-model RGM-calculation of n^4He scattering with realistic NN-interactions are discussed. 22 refs.

50027 (IAE–4762-2) **Optimization of kinematically complete experiments in four-particle nuclear reactions by simulation method.** Mukha, I.G.; Chulkov, L.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 24p. (In Russian). Order Number DE91601219. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The Monte-Carlo simulation of kinematically complets experiments studying three-body decays of resonances formed in nuclear reactions are described. Calculation results of optimum conditions for the kinematically complete experiment studying exotic modes of three-particle ^6Be decay are given, which are characterized by strong correlations of decay products. 12 refs.; 10 figs.

50028 (IAE–4876-2) **Strength function of xenon 127 and cross section of $^{127}I(\nu_e, e^-)^{127}Xe$ reaction.** Lyutostanskij, Yu.S.; Shul'gina, N.B. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 12p. (In Russian). Order Number DE91601220. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The strenght functions $S_\beta(E)$ and the cross section of the reaction $\nu_e + ^{127}I \rightarrow e^- + ^{127}Xe$ were calculated in the framework of the theory of finite Fermi-systems. The results obtained are used to estimate the possibility of using an iodine-xenon detector in the experiments with solar neutrinos and reactor antineutrinos. The advantages of the iodine-xenon detector over the chlorine-argon one are shown. 13 refs.; 6 figs.; 3 tabs.

50029 (INS–816) **Spin dynamics of the itinerant helimagnet MnSi studied by positive muon spin relaxation.** Kadono, R. (Tokyo Univ. (Japan). Faculty of Science); Matsuzaki, T.; Yamazaki, T.; Kreitzman, S.R.; Brewer, J.H. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Mar 1990. 9p. Order Number DE90520206. Source: NTIS (US Sales Only), PC A02/MF A01.

The local magnetic fields and spin dynamics of the itinerant helimagnet MnSi($T_c \simeq 29.5$ K) have been studied experimentally using positive muon spin rotation/relaxation (μ^+SR) methods. In the ordered phase ($T < T_c$), zero-field μSR was used to measure the hyperfine fields at the muon sites as well as the muon spin-lattice relaxation time T_1^μ. Two magnetically inequivalent interstitial μ^+ sites were found with hyperfine coupling constants $A_{hf}^{(1)} = -3.94$ kOe/μ_B and $A_{hf}^{(2)} = -6.94$ kOe/μ_B, respectively. In the paramagnetic phase ($T > T_c$), the muon-nuclear spin double relaxation technique was used to simultaneously but independently determine the spin-lattice relaxation time T_1^{Mn} of ^{55}Mn spins and that of positive muons (T_1^μ) over a wide temperature range ($T_c < T \leq 150$ K). The temperature dependence of T_1^{Mn} and T_1^μ in both phases shows systematic deviations from the predictions of self-consistent renormalization (SCR) theory. (author).

50030 (INS–822) **Towards high-density matter with relativistic heavy-ion collisions.** Nagamiya, Shoji. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Apr 1990. 23p. Order Number DE90520259. Source: NTIS (US Sales Only), PC A03/MF A01.

Recent progress in nucleus-nucleus collisions at BNL and CERN suggests a hint that the formation of high-density nuclear matter could be possible with relativistic heavy-ion beams. What is the maximum density that can be achieved by heavy-ion collisions? Are there data which show evidence or hints on the formation of high density matter? Why is the research of high-density interesting? How about the future possibilities on this subject? These points are discussed. (author).

50031 (INS–828) **Nuclear spectroscopy and quantum chaos.** Sakata, Fumihiko; Marumori, Toshio; Hashimoto, Yukio; Yamamoto, Yoshifumi; Tsukuma, Hidehiko; Iwasawa, Kazuo. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. May 1990. 15p. Order Number DE90520335. Source: NTIS (US Sales Only), PC A03/MF A01.

In this paper, a recent development of INS-TSUKUBA joint research project on large-amplitude collective motion is summerized. The classical theory of nuclear collective dynamics formulated within the time-dependent Hartree-Fock theory is recapitulated and decisive role of the level crossing in the single-particle dynamics on the order-to-chaos transition of collective motion is discussed in detail. Extending the basic idea of the classical theory, we discuss a quantum theory of nuclear collective dynamics which allows us to properly define a concept of quantum chaos for each eigenfunction. By using numerical calculation, we illustrate what the quantum chaos for each eigenfunction means and its relation to usual definition based on the random matrix theory. (author).

50032 (ITEP–144-88) **Production of high energy nuclei ^4He,^3He,^3H,^2H in interaction 10.1 GeV/c protons with Be,Al,Cu,Ta.** Safronov, G.A. (and others); Smirnov, G.N.; Sibirtsev, A.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1988. 12p. Order Number DE91601160. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The yields of light fragments at 3.5 deg have been measured for proton nuclei reactions. Experimental data for alpha particle ^3He,^3H, deuteron production are discussed in terms of phenomenological coalescence model. 11 refs.; 4 figs.

50033 (ITP–88-158) **Threshold anomaly in doublet nd-scattering.** Shapoval, D.V.; Simenog, I.V. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1988. 24p. Order Number DE91601161. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The doublet nd-scattering amplitude behaviour near the three-particle threshold is studied analytically and numerically. The scattering amplitude possesses an anomaly caused by the small energy of singlet deuteron virtual level. The anomaly manifests itself as a bend in the energy dependence of the real part of the scattering phase shift in the range of about 0.5 MeV and in a non-standard behaviour of the break-up cross-section near the threshold. 26 refs.; 5 figs.; 2 tabs.

50034 (ITP–89-3) **Comparison of theoretical and phenomenological phase shifts for $^3He(\alpha,\alpha)^3He$ scattering at ^7Be excitation range between 25 and 42 MeV.** Ostashko, V.V.; Yasnogorodskij, A.M.; Filippov, G.F.; Vasilevskij, V.S.; Nesterov, A.V. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1989. 12p. Order Number DE91601162. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

New resonances of ^7Be at excitation energies about 30 MeV are discovered as the result of phase shift analysis of experimental data for $^3He+\alpha$ and ^3He-vector$+\alpha$ elastic scattering, in qualitative aggreement with microscopic calculations based on resonating group method. 11 refs.; 5 figs.

50035 (JINR–2-35-89, pp. 21-26) **Interference of the main diagrams of OPER-model for reaction $np \rightarrow np\,\pi^+\pi^-$ at energies 1-5 GeV.** Ierusalimov, A.P. (and others); Moroz, V.I.; Stel'makh, A.P. Joint Inst. for Nuclear Research, Dubna (USSR); Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation. 1989. (In Russian). In *JINR rapid communications: Collection.* Order Number DE90706214. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

The interference effects are studied for the main diagrams of reggeized π-exchange model (OPER) of the reaction $np \rightarrow np\pi^+\pi^-$. It is shown that the interference effects must be taken into account at the incident momenta neutrons below 3 GeV/c. The contribution of the interference part is 23% at P_0=1.73 GeV/c for the cross section calculated by OPER-model. 6 refs.; 4 figs.

50036 (JINR–2-35-89, pp. 5-10) **Automodelity of proton cluster distributions in the range of the first intermediate asymptotics.** Kechechyan, A.O. (Erevanskij Fizicheskij Inst., Erevan (USSR)); Shakhbazyan, B.A. Joint Inst. for Nuclear Research, Dubna (USSR); Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. 1989. (In Russian). In *JINR rapid communications: Collection.* Order Number DE90706214. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

Experimental results on proton cluster distributions over the relativistically-invariant quantity b_{all} from nC-and π^-C-interactions confirm the applicability of the automodelity principle of the second kind to our case. It was shown that in the range of the first intermediate asymptotics ($b_{all} >> 0.01$) these distributions can be well fitted by an exponential function at the exponent value $n \approx 4$. This value does not depend on b_k for $b_k < 0.05$ both for nC-and π^-C-interactions. 9 refs.; 3 figs.; 1 tab.

50037 (JINR–2-35-89, pp. 27-33) **Microscopic description of neutron and proton transition moments in spherical nuclei.** Nikolaeva, R.M. Joint Inst. for Nuclear Research, Dubna (USSR); Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1989. In *JINR rapid communications: Collection.* Order Number DE90706214. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

Neutron and proton transition matrix elements for low-lying quadrupole transitions are calculated microscopically in the framework of the quasiparticle phonon nucleaar model in some spherical nuclei. For isoscalar states M_n and M_p are of the same value and sign, and for the isovector states they are predicted to be of the same value and opposite sign. The isoscalar and isovector states are differently excited in inelastic scattering of protons and deuterons. 13 refs.; 2 tabs.

50038 (JINR-E–2-89-37) **Polarization phenomena in reactions of deuteron stripping type.** Dolidze, M.G. (Tbilisskij Gosudarstvennyj Univ., Tbilisi (USSR)); Lykasov, G.I. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems. 1989. 4p. Order Number DE91601163. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Submitted to Pis'ma Zh. Ehksp. Teor. Fiz.

A strong sensitivity of both the inclusive spectra of forward-going protons in the stripping reaction $dN \rightarrow pX$ and the tensor component of deuteron polarization T_{20} to the reaction mechanism is shown. The role of relativistic effects at the deuteron decay into two nucleons is discussed in the analysis of T_{20}. 15 refs.; 2 figs.

50039 (JINR-E–4-89-51) **The multiphonon version of the quasiparticle-phonon nuclear model: application to the problem of existence of low-lying two-phonon states in deformed nuclei.** Nesterenko, V.O. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1989. 18p. Order Number DE91601126. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Submitted to Nucl. Phys., A.

The multiphonon version of the quasiparticle-phonon nuclear model (QPNM) conventient for an analysis of an interaction between configurations with a different number of phonons is proposed. The properties of the matrix elements coupling these configurations are discussed in detail. It is shown that if violation of the Pauli principle shifts the strengths of low-lying two-phonon states towards higher excitation energies, the interaction with complex configurations (three-phonon, etc.) provides the opposite effect of the same order. As a result, the multiphonon version of the QPNM admits the existence of low-lying two-phonon states in deformed nuclei thus removing the discrepancy between the QPNM and other microscopic models. 16 refs.; 1 fig.; 2 tabs.

50040 (JINR-E–4-89-165) **Neutron-proton ratios of collective quadrupole matrix elements in even Fe and Cr isotopes.** Antalik, R. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1989. 10p. Order Number DE91601124. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Submitted to Mod. Phys. Lett. A.

M_n/M_p ratios are investigated within the QRPA framework for the low-lying quadrupole states and for isoscalar giant quadrupole resonances in $^{54,56,58}Fe$ and $^{50,52,54}Cr$. Theoretical results for 2_1^+ states are in good agreement with empirical ones obtained from recent proton and pion inelastic scattering studies. 16 refs.; 3 tabs.

50041 (JINR-E–4-89-211) **Description of low-lying vibrational $K^\pi \neq 0^+$ states of deformed nuclei in the quasiparticle-phonon nuclear model.** Solov'ev, V.G.; Shirikova, N.Yu. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1989. 35p. Order Number DE91601125. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Submitted to Z. Phys., A.

The QPNM equations are derived taking account of p-h and p-p interactions. The calculated quadrupole, octupole and hexadecapole vibrational states in ^{168}Er, ^{172}Yb and ^{178}Hf are found to be reasonale agreement with experimental data. It is shown that distribution of the $E\lambda$ strength in some deformed nuclei differs from the standard one. There are cases when for a given K^π and $E\lambda$ strength is concentrated not on the first but on higher-lying states. The assertion made earlier about the absence of collective two-phonon states in deformed nuclei is confirmed. 44 refs.; 1 fig.; 6 tabs.

50042 (JINR-R–1-89-47) **Search for strangeness-abundant quark-gluon matter in nucleus-nucleus and antiproton-nucleus interactions.** Okonov, Eh.O. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. 1989. 14p. (In Russian). Order Number DE91601164. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Peculiarities of the strangeness production process in nuclei are considered as a useful tool for studies of the excited states of hadron matter and for a search for signals of phase transition in quark-gluon matter (quagma). The experimental data are analyzed to compare nucleus-nucleus (A_PA_T) and antiproton-nucleus interactions in which there is an indication of the thermalization of hadron matter as the necessary condition for quagma formation. Angular distributions of produced Λ-hyperons appeared to be close to isotropic ones in the CM system of nucleonic cluster N_P+(10-15)N_T. In p-barA interactions one cannot expect large baryonic densities therefore the strangeness abundance does not provide a good signal for quagma formations and this phase transition requires considerably higher temperatures. On the other hand, in central A_PA_T collisions the number of thermalized clusters and, consequently, the magnitude of expected effects can be much more larger due to a larger number of interacting nucleons of the nucleus A_P. 27 refs.; 9 figs.; 1 tab.

50043 (KIFVE–87-19) **On the strange particle production in the nuclear pionization model.** Ameev, S.Sh.; Tulegenov, M.Sh.; Shmonin, V.L. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. 23p. (In Russian). Order Number DE91601167. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The process of K^+-meson production in reactions Ne+NaF and Ne+Pb at the energy of T_0=2.1 GeV/n is considered within the framework of the nuclear pionization model. It is shown that the model's calculations are in satisfactory agreement with experiments. The magnitude is determined for correlation radius restricting the space region where the strange particle pair production is localized with the strangeness preservation. 18 refs.; 5 figs.

50044 (KIFVE–88-08, pp. 3-9) **K^--meson production in relativistic nuclear collisions and nuclear pionization model.** Tulegenov, M.Sh. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. (In Russian). In *Proceedings of the seminar of young scientists HEPI AN Kaz SSR. Part 1: 1. High energy physics and computer technique.* Order Number DE90706215. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Formation of K^--mesons in reaction Si+Si at energy 2.1 GeV/nucleon is discussed in the framework of the nuclear pionization model (NPM). According to NPM, three excited thermodynamic systems: a central pionized cluster (CPC) and two baryons in the regions of fragmentation of a charge and a target, are formed in collision of relativistic nuclei. Thermodynamic decay of CPC which is the source of most of produced particles is considered. At initial energies of several GeV/nucleon, the number of strange particles producing is small, that's why it is necessary to take into account the local character of their pair production. The volume, where strange particle pair production is localized, is proportional to the cube of correlation radius R_{cor}= 1.1 Fm. Nucleons, Δ-resonances, Λ- and Σ-hyperons, kaons and pions are considered as components of CPC decay state. CPC decay characteristics are determined by the set of equations proceeding from the laws of conservation under conditions of chemical equilibrium at a given decay density. It is shown that K^--mesons possessing large cross section of absorption are produced together with pions at relatively late stage of CPC widening. 9 refs.; 1 fig.

50045 (KIFVE–88-08, pp. 10-16) **Partial inelasticity coefficients in hadron-nucleus interactions.** Temiraliev, A.T. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. (In Russian). In *Proceedings of the seminar of young scientists HEPI AN Kaz SSR. Part 1: 1. High energy physics and computer technique.* Order Number DE90706215. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

It is shown that weak dependence of the coefficients of inelasticity of hadron-nuclear interactions on the mass number of a nucleus-target can be interpreted in the framework of additive quark model of multiple processes if taking into account the jet character of these processes to estimate exactly the mean quark energy captured by quark spectators from jets. 7 refs.

50046 (KIFVE–88-08, pp. 17-24) **Simulation of angle interval distribution in collisions of relativistic nuclei and comparison with experiment.** Prilepskij, Yu.B. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. (In Russian). In *Proceedings of the seminar of young scientists HEPI AN Kaz SSR. Part 1: 1. High energy physics and computer technique.* Order Number DE90706215. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Formation of proton groups from a target nucleus in the azimuthal plane, when interacting heavy nuclei of cosmic rays with heavy nuclei of photoemulsion, is investigated. Distribution of intervals of angles between tracks according to the model of independent particle escape, which is further compared with the same distribution obtained in experiment. It is shown that development in the experiment of two-maximal distribution of intervals is not the result of random fluctuations of isotropic distribution of particles in the azimuth, but is the evidence in favour of the supposition about the presence of baryon jets in the process of multiple production in AA-collisions. 8 refs.; 2 figs.

50047 (KIFVE–88-12) **Determination of number of interacting nucleons in the nuclear pionization model.** Ameev, S.Sh.; Tulegenov, M.Sh.; Shmonin, V.L. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. 40p. (In Russian). Order Number DE91601171. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

In a model of nuclear pionization the collision of relativistic nuclei occurs by means of formation and decay of three intermediate thermodynamic systems. The central pionized cluster (CPC) is formed by gluon fields of interacting nucleons. Their valence quarks, being relatively passive, pass through the region of interaction and they form two baryon clusters (BC) in the region of fragmentation of charge and target CPC is the main source of secondary particles and BS decays, mainly, to nucleons. Interaction of BC at the outlet from a nucleus with nucleons of the same nucleus occurs at the second stage of the process. The basic leading system (LS) without a soft part of a parton spectrum interacts relatively weak with nucleon of nucleus-partner because in the system of its staying LS residence time in the passive state extended by γ-factor relatively to nuclei motion. As for as BC yields from its nucleus it interacts with nucleons taking no part in forming CPC. The calculation results of the model of nuclear pionization with a total number of interacting nucleons agree satisfactory with the present experimental data. It is shown that account of interactions at the second stage of the process becomes essential with the growth of the atomic number of the target nucleus. Comparison with calculations of one of the versions of the Glauber model for AA-collisions is carried out. 23 refs.; 9 figs.; 2 tabs.

50048 (N–90-24121) **Chiral interface at the finite temperature transition point of QCD.** Frei, Z.; Patkos, A. Fermi National Accelerator Lab., Batavia, IL (USA). May 1990. 13p. (NASA-CR–186605;NAS–1.26:186605;FERMILAB-PUB–90/114-A). Source: NTIS, PC A03/MF A01.

The domain wall between coexisting chirally symmetric and broken symmetry regions is studied in a saddle point approximation to the effective three-flavor sigma model. In the chiral limit the surface tension varies in the range ((40 to -50)MeV)(exp 3). The width of the domain wall is estimated to be approximately or equal to 4.5 fm.

50049 (RCNP-P–107, pp. 121-128) **Inelastic proton scattering from deformed nuclei at intermediate energy.** Kamigaito, Osamu (Kyoto Univ. (Japan). Dept. of Physics). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8903211–: Workshop on cyclotron cascade project, Ibaraki (Japan), 13-15 Mar 1989). In *Proceedings of the workshop on 'cyclotron cascade project'.* Order Number DE90777870. Source: NTIS (US Sales Only), PC A11/MF A01.

Relativistic research on nuclear reactions and nuclear structures has become an important area in recent nuclear physics. The present article briefly reviews recent analyses carried out by means of the relativistic coupled-channels formalism. Major applications of the coupled-channels approach to inelastic scattering are outlined and some possible experiments that could be performed at RCNP are discussed. A coupled-channels equation is derived from the Dirac's formula which describes the scattering of protons. Studies cited include calculations of elastic and inelastic scattering made by a Dirac-type coupled-channels equation, those by a Dirac-based Schroedinger-type coupled channels equation, analysis of elastic and inelastic scattering to the rotational band in the ground state of ^{24}Mg made by Dirac-type and Schroedinger-type equations. Effects of the structural irregularity may be significant in the case of light deformed nuclei such as ^{24}Mg. Grand Raiden, a high-resolution spectrograph to be constructed at RCNP will help measure the inelastic scattering of some rare earth nuclei. (N.K.).

50050 (RCNP-P–108, pp. 52-60) **Pair correlation of superdeformed rotation band.** Shimizu, Yoshio (Kyushu Univ., Fukuoka (Japan). Faculty of Science). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

The effect of pair correlation, one of the most important residual interactions associated with the super-deformed rotation band, is discussed in terms of the characteristics of the rotation band (its effect on the moment of inertia in particular), and the tunneling into an normal deformed state in relation to its effect on the angular momentum dependence of the potential energy plane as a function of the deformation. The characteristics of the rotation band is discussed in terms of the kinematic and dynamic momenta of inertia. It is shown that the pair correlation in a super-deformed rotation band acts to decrease the former and increase the latter momentum mainly due to dynamic pair correlation. A theoretical approach that takes this effect into account can provide results that are consistent with measured momenta, although large differences can occur in some cases. Major conflicts include a large measured kinetic momentum of inertia compared to the theoretical value, and the absence of the abnormality (shape increase) generally seen in low-spin experiments. The former seems likely to be associated with the method of measuring the angular momentum. (N.K.).

50051 (TRI-PP–90-44) **Superallowed Fermi beta-decay: Applications.** Wilkinson, D.H. (British Columbia Univ., Vancouver, BC (Canada). TRIUMF Facility). British Columbia Univ., Vancouver, BC (Canada). TRIUMF Facility. Jun 1990. 6p. (CONF-9006274–1: 12. PANIC international conference on particles and nuclei, Cambridge (UK), 25-29 Jun 1990). Order Number DE90017757. Source: NTIS (US Sales Only), PC A02/MF A01 - OSTI.

This paper, Superallowed Fermi Beta-Decay, is discussed, along with applications. (LSP)

6540 Radiation and Shielding Physics

Refer also to citation(s) 48593, 49276, 49347, 49355, 49371, 49376

50052 (CONF-900970–3) **Computation of standard deviations in eigenvalue calculations.** Gelbard, E.M. (Argonne National Lab., IL (USA)); Prael, R. Argonne National Lab., IL (USA). [1990]. 10p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From International conference on Monte Carlo methods in neutron and photon transport; Budapest (Hungary); 25-28 Sep 1990. Order Number DE90017809. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Brissenden proposes a modified Monte Carlo method for eigenvalue calculations, designed to decrease biases in the flux and eigenvalue estimates, and in corresponding estimates of standard deviations. The proposed method is based on the generation of "superhistories," chains of histories run in sequence without intervening renormalization of the fission source. This method appears to have some disadvantages, discussed in another paper of this conference, e.g., first, the new method requires substantial changes in existing codes and second, it may increase variances in computations where long superhistory chains are needed. In PWR's, for example, dominance ratios $\gtrsim$0.95 are not unusual, and it seems likely that chains of length 10 will, in such cases, still be strongly correlated. Earlier numerical experiments suggest that biases in fluxes and eigenvalues are negligibly small, even for very small numbers of histories per generation. Now more recent experiments, run on the CRAY-XMP, tend to confirm these earlier conclusions. The new experiments discussed in this paper involve the solution of one-group 1D diffusion theory eigenvalue problems, in difference form, via Monte Carlo. Experiments covered a range of dominance ratios from $\approx$0.75 to $\approx$0.985. In all cases flux and eigenvalue biases were substantially smaller than one standard deviation.

50053 (CONF-901121–6) **On the adequacy of message-passing parallel supercomputers for solving neutron transport problems.** Azmy, Y.Y. Oak Ridge National Lab., TN (USA). [1990]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Association for Computing Machinery/Institute of Electrical and Electronics Engineers supercomputing conference; New York, NY (USA); 12-16 Nov 1990. Order Number DE90016041. Source: NTIS, PC A02/MF A01; OSTI; INIS.

A coarse-grained, static-scheduling parallelization of the standard iterative scheme used for solving the discrete-ordinates approximation of the neutron transport equation is described. The parallel algorithm is based on a decomposition of the angular domain along the discrete ordinates, thus naturally producing a set of completely uncoupled systems of equations in each iteration. Implementation of the parallel code on Intel's iPSC/2 hypercube, and solutions to test problems are presented as evidence of the high speedup and efficiency of the parallel code. The performance of the parallel code on the iPSC/2 is analyzed, and a model for the CPU time as a function of the problem size (order of angular quadrature) and the number of participating processors is developed and validated against measured CPU times. The performance model is used to speculate on the potential of massively parallel computers for significantly speeding up real-life transport calculations at acceptable efficiencies. We conclude that parallel computers with a few hundred processors are capable of producing large speedups at very high efficiencies in very large three-dimensional problems. 10 refs., 8 figs.

50054 (IAE–4774-5) **FORTUN-88 physical module for calculation by Monte-Carlo method with microconstants on the estimated data file basis.** Markovskij, D.V.; Borisov, A.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 27p. (In Russian). Order Number DE91601115. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The physical module for treatment of neutron collision in the fast region, adapted to the MCU package of applied codes, is described. The method is oriented to detailed processes in the fast energy range and is a combination of the group approach in representation of process probabilities and elastic scattering anisotropy and individual description of the inelastic process secondary neutron spectra based on the evaluated data files. 9 refs.; 3 tabs.

50055 (IFUSP-P–839) **Manual for target thickness measurement by alpha particle irradiation.** Dias, J.F.; Martins, M.N. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Apr 1990. 15p. (In Portuguese). Order Number DE91601118. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A system is described for thin-target thickness measurement through the alpha particle energy loss when them traverse the target. It is also described the program used in the analysis of the target thickness. (L.C.).

50056 (INDC(CCP)–314) **The neutron leakage spectrum for an iron sphere with a central 14 MeV neutron source.** Borisov, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Zagryadskij, V.A.; Chuvilin, D.Yu.; Kralik, M.; Pulpan, Ya.; Tikhy, M. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. May 1990. 13p. Translated by the IAEA from the Russian report IAE-4990/8, Moscow 1989. Order Number DE91601116. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Translated by the IAEA from the Russian report IAE-4990/8, Moscow 1989.

In this paper we present the experimental results and their comparison with calculations of the neutron leakage spectrum for an iron sphere with a wall thickness of 7.5 cm in the 1-15 MeV region. The measurements were performed with a scintillation spectrometer. 15 refs, 4 figs, 6 tabs.

50057 (KIFVE–88-09, pp. 26-31) **Calculation of energy release depth distributions for electrons with 5-100 MeV energy in thick targets.** Zavgorodnij, S.F. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. (In Russian). In *Proceedings of the seminar of young scientists HEPI AN Kaz SSR. Part 2: 2. Solid state physics and mass transfer simulation.* Order Number DE90706213. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Calculations of energy release in Al, Cu, Pb targets irradiated usually by incidence electrons with energies 5, 10, 25, 50, 100 MeV are presented by the Monte Carlo method according to the diagram of enlarged collisions. Distributions in depth of energy release of primary electrons and secondary particles, which average number of generation increases smoothly with the growth of the energy of primary electrons and the atomic number of the target are obtained. It is shown that secondary particles form a localized

band of energy release, which shifts to the target depth with the increase of the primary electron energy and which increases the contribution to total distribution. 7 refs.; 2 figs.

50058 (KIFVE–88-09, pp. 32-38) **Application range of the impulse approximation at calculation of ion transport in matter.** Fajn, V.Eh. (Kazakhskij Gosudarstvennyj Univ., Alma-Ata (USSR)); Yuldashev, M.M.; Chubisov, M.A. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. (In Russian). In *Proceedings of the seminar of young scientists HEPI AN Kaz SSR. Part 2: 2. Solid state physics and mass transfer simulation.* Order Number DE90706213. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The problem on ion transport in the amorphous substance is discussed. The region of applicability of pulse approximation when calculating ion transort in the substance is considered. The results obtained permit to obtain reliable integral and differential energy-angular characteristics when simulating ion scattering in the amorphous substance. 8 refs.; 2 figs.

50059 (KIFVE–88-09, pp. 39-44) **About applicability of binary collisions model in the theory of ion transport in matter.** Khlupin, S.I. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. (In Russian). In *Proceedings of the seminar of young scientists HEPI AN Kaz SSR. Part 2: 2. Solid state physics and mass transfer simulation.* Order Number DE90706213. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The theory of ion transport in a substance is discussed in the framework of binary collisions. Approximation of binary collisions is based on a classical description of ion and atomic electron collision, and it is a case of plane-wave Born approximation. The results of calculation according to the model given, when using the Gryzinskij model of cross sections of C, Si and Ag atom ionization with protons are presented.

50060 (LA-UR–90-2514) **Monte Carlo next-event estimates from thermal collisions.** Hendricks, J.S.; Prael, R.E. Los Alamos National Lab., NM (USA). [1990]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-901101–21: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE90014896. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A new approximate method has been developed by Richard E. Prael to allow S(α,β) thermal collision contributions to next-event estimators in Monte Carlo calculations. The new technique is generally applicable to next-event estimator contributions from any discrete probability distribution. The method has been incorporated into Version 4 of the production Monte Carlo neutron and photon radiation transport code MCNP. 9 refs.

6550 Medical Physics

Refer also to citation(s) 48994, 49346, 49347, 49350, 49360, 49561, 49701, 49980

50061 (BARC–1483) **Pre-operational external radiation monitoring in NAPP environs using TLDs (Jan 1987 - Mar 1989).** Basu, A.S. (Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.); Sharma, L.N.; Nambi, K.S.V. Bhabha Atomic Research Centre, Bombay (India). 1989. 16p. Order Number DE91601980. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Assessment of environmental impact due to operation of a nuclear power plant requires the knowledge of the pre-operational baseline natural radiation levels around the plant. With this objective in view, environmental TLDs are placed in about twenty locations around the plant in different directions and distances. This report presents quarterly exposure data during the period Jana.'87-Mar.'89. The salient results are: (1) The distributions of quarterly rates of exposure in most of the places are unimodal on a lognormal plot; (2) the natural background radiation level typical for NAPP site based on these locations works out to be 142 ± 30(1σ)mR/year. Such a value is expected because of the Gangetic alluvial terrains carrying significant primordial radioactivity. (author). 4 figs., 6 refs., 1 tab.

50062 (BARC–1492) **A study of radon variation in dwelling during 1988.** Shaikh, A.N. (Bhabha Atomic Research Centre, Bombay (India). Pollution Monitoring Section); Ramachandran, T.V.; Muraleedharan, T.S.; Subbaramu, M.C. Bhabha Atomic Research Centre, Bombay (India). 1989. 19p. Order Number DE91601981. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Natural radioactivity due to radon and its progeny levels indoors contributes significantly to the total radiation to man. The main source of radon and its progeny in a dwelling is the emanation of radon gas from soil. The temperature and ventilation vary in a dwelling during the year. These parameters influence the indoor radon levels. The seasonal variation of radon was studied in a dwelling as well as in the outside air. The filter paper method and alpha counting, and the solid state track detector technique and track counting were used to study the radon levels. The geometric mean of radon daughters concentrations were 0.5 mWL and 0.8 mWL measured by filter-paper method and SSNTD method respectively. The geometric mean of radon concentrations were 6.2 Bqm^{-3} and 10.0 Bqm^{-3} by filter-paper method and SSNTD method respectively. (author). 3 figs., 3 tabs., 13 refs.

50063 (CONF-901067–1) **Radiation protection of the public: Past, present, and future.** Kocher, D.C. Oak Ridge National Lab., TN (USA). [1990]. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Symposium on environmental radiation and public policy; Las Vegas, NV (USA); 23-25 Oct 1990. Order Number DE90017747. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper discusses the historical development of radiation protection standards for the public, the present system in the United States for limiting radiation exposures of the public primarily by means of environmental radiation standards for specific practices or sources, and recent developments that may affect future standards and policies for radiation protection of the public. The radiobiological and epidemiological basis for radiation protection standards and policies is emphasized. Difficulties associated with the current regulatory framework are discussed, and proposal for addressing these difficulties are presented. 16 refs., 1 tab.

50064 **Calibration of detector sensitivity in positron cameras.** Chesler, D.A. (Massachusetts General Hospital, Boston, MA (USA). Physics Research Lab.); Stearns, C.W. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA)*, 37(2): 768-772 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

An improved method for calibrating detector sensitivities in a positron camera has been developed. The calibration phantom is a cylinder of activity placed near the center of the camera and fully within the field of view. The calibration data is processed in such a manner that the following two important properties are achieved. The estimate of a detector sensitivity is unaffected by the sensitivities of the other detectors. The estimates are insensitive to displacements of the calibrating phantom from the camera center. Both of these properties produce a more accurate detector calibration.

6560 Condensed Matter Physics

Refer also to citation(s) 48086, 48900, 48905, 48945, 48954, 49036, 49079, 49130, 49861, 49917, 50146

50065 (BISI-NF-TRANS–234) **Application of ion beam sputtering for diffusion study in solids.** Shin-ichiro, Fujisawa. Institute of Metals, London (UK). [1989]. 19p. Translated from Bulletin of the Japan Institute of Metals, 1986, v.25(7) p. 608-614. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Translated from Bulletin of the Japan Institute of Metals, 1986, v.25(7) p. 608-614.

Two techniques involving ion beam sputtering are discussed in relation to their application to diffusion research in cases where the diffusion coefficient is very low. The first of these combines microsectioning by means of ion beam sputtering with a radioactive tracer. Examples given of research using this technique are: self

diffusion in single crystals of α-Zr; self diffusion in amorphous metals; temperature and pressure dependence of the self diffusion coefficient in single crystals of Au at low temperatures and in Ge single crystals. The second technique is secondary ion mass spectroscopy (SIMS) depth direction analysis. Recent research using SIMS has included the diffusion of Co impurities in single crystals of Cu and Ge impurity diffusion in Si single crystals. These researches could not have been carried out effectively, or in some cases at all, by means of more conventional techniques. (UK).

50066 (CBPF-MO-001/89, pp. 229-277) **Electronic origins of NMR parameters.** Contreras, R.H. (Buenos Aires Univ. (Argentina). Dept. de Fisica); Giribet, C.G.; Azua, M.C.R. de. Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1988. (In Spanish). (CONF-8809500--: 1. State Meeting of New Materials, Rio de Janeiro (Brazil), 26-28 Sep 1988). In *6. Latin American School on Theoretical Chemistry. v. 1.* Source: Available from the Library of the Comissao Nacional de Energia Nuclear, RJ, Brazil.

The Nuclear Magnetic Resonance (NMR) spectroscopy is a powerful tool for the understanding of many theoretical aspects of molecular physics. In this work, many of these aspects as well as its applications will be discussed. (A.C.A.S.).

50067 (CBPF-NF-006/89) **EPR studies of photolysis of HbNO at low temperatures.** Linhares, M.P.; El-Jaick, L.J.; Bemski, G.; Wajnberg, E. Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1989. 31p. Order Number DE91600635. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Photolysis of HbNO has been studies below 20K by electron spin ressonance at continuous illumination. Non exponential kinetics of both dissociation and reassociation of NO have yielded a consistent picture of NO tunneling to probably more than one site distant less than 0.1nm from the bound position. This result is obtained using the model of conformation substates or a model of a sum of two exponentials. (author).

50068 (CONF-900914--1) **Surface anharmonicity: Temperature dependence of phonon energies on Cu(110).** Baddorf, A.P. (Oak Ridge National Lab., TN (USA)); Plummer, E.W. Oak Ridge National Lab., TN (USA). [1990]. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Grant DMR-85-19059;Grant DMR-85-10491. From Vibrations at surfaces; Shelter Island, NY (USA); 10-14 Sep 1990. Order Number DE90017735. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The temperature dependence of surface phonons on Cu(110) has been determined with high resolution electron energy loss spectroscopy between 21 and 766 K. Phonons at $\bar{\Gamma}$ and at $\bar{Y}$, both with atomic motion perpendicular to the surface, have been examined to assess the importance of anharmonicity at the surface. As the temperature is increased the observed phonon energies decrease and the linewidths increase. The same percentage decrease is observed at $\bar{\Gamma}$ and $\bar{Y}$. A simple model using an anharmonic potential can reproduce the magnitude and shape of the temperature dependence of the phonon at $\bar{\Gamma}$. Direct comparison with bulk phonon studies shows that the anharmonicity at the surface is 4.1–4.8 times greater. 18 refs., 5 figs.

50069 (CONF-900936--4) **High energy iron ion implantation into sapphire.** Allen, W.R.; Pedraza, D.F. Oak Ridge National Lab., TN (USA). [1990]. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 7. international conference on ion beam modification of materials; Knoxville, TN (USA); 9-14 Sep 1990. Order Number DE90017736. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Sapphire specimens of c-axis orientation were implanted at room temperature with iron ions at energies of 1.2 and of 2 MeV to various fluences up to 8×10^{16} cm^{-2}. The damage induced by the implantations was assessed by Rutherford backscattering spectroscopy in random and channeling geometries. Dechanneling in both sublattices was observed to saturate for all implantation conditions. Disorder in the aluminum sublattice was found to increase with depth at a significantly slower rate than in the oxygen sublattice. In the oxygen sublattice, a relative yield, χ, of 0.80 $\pm$ 0.11 was attained at a depth of 0.1 μm and remained constant up to the measured depth of 0.45 μm. In the aluminum sublattice, the disorder increased with depth and the dechanneling asymptotically approached χ=0.70 $\pm$ 0.04 at 0.45 μm. These results are discussed and compared with those for shallower Fe implantations obtained by other researchers.

50070 (IAE-4727-1) **Plane channeling and radiation of ultrarelativistic electrons in thick crystals.** Starostin, V.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1988. 5p. (In Russian). Order Number DE91600711. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

A theory of passing fast charged particles through single crystals with defects of any origin is built. An optimal thickness at which the radiation output is maximal is found: $0.854/\mu(E_\gamma)$. 11 refs.

50071 (IFUSP-P-827) **Luminescence study of spodumene.** Isotani, S. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Fujii, A.T.; Antonini, R.; Pontuschka, W.M.; Rabani, S.R.; Furtado, W.W. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Feb 1990. 22p. Order Number DE91600636. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A comparative study is made of the luminescence of five kinds of spodumene from Minas Gerais, Brazil, studied previously by optical absorption spectroscopy. Natural gemstones are used which, in the course of the experiments, were irradiated with X-rays. (L.C.).

50072 (INS-820) **Application of in-beam perturbed angular distribution to the study of high-T_c oxides.** Komori, Fumio (Tokyo Univ. (Japan). Dept. of Physics); Katsumoto, Shingo; Kobayashi, Shun-ichi; Ikehata, Seiichiro; Ikeda, Nobuo; Hashimoto, Osamu; Fukuda, Tomokazu; Nomura, Toru; Yamazaki, Toshimitsu. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Apr 1990. 10p. Order Number DE90520227. Source: NTIS (US Sales Only), PC A02/MF A01.

The time differential perturbed angular distribution method was applied to the study of high-T_c oxides. Spin rotation signals of the ^{19}F isomer (τ = 128 nsec) produced from oxygen nuclei via ^{16}O(α,p)^{19}F were observed in various high-T_c oxides above T_c. The internal field was determined with the accuracy of about 1%. This method is an alternative to the ^{17}O substituted NMR. (author).

50073 (IPNO-DRE-89-25) **Laser spectroscopy of laser-desorbed gold isotopes.** Le Blanc, F. (Paris-11 Univ., 91 - Orsay (FR). Inst. de Physique Nucleaire); Kilcher, P.; Obert, J.; Oms, J.; Putaux, J.C.; Roussiere, B.; Sauvage, J.; Duong, H.T.; Pinard, J.; Liberman, S.; Savard, G.; Crawford, J.E.; Lee, J.K.P.; Thekkadath, G. ISOCELE Collaboration. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1989. 20p. Order Number DE91700562. Source: NTIS (US Sales Only), PC A03/MF A01.

Changes in mean-square charge radius $\delta\langle r^2\rangle$, and magnetic dipole moments μ_I have been measured for a series of neutron-deficient gold isotopes between A=186 and 196, and for neutron-rich ^{198}Au and ^{199}Au, using the PILIS system on-line with the ISOCELE mass separator. These measurements confirm the existence of the shape transition between A=186 and 187. The measured μ_I values have been compared with calculations using Nilsson, and Symmetric Rotor+Quasiparticle models. The results are consistent with the interpretation that ^{186}Au is prolate, and that the heavier isotopes have oblate, or possibly triaxial deformation.

50074 (IS-M-634) **NMR [nuclear magnetic resonance] studies of hydrogen in metals and hydrides at very high temperatures.** Barnes, R. (Ames Lab., IA (USA)). Iowa State Univ. of Science and Technology, Ames, IA (USA). [1988]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. (CONF-880969--12: International symposium on metal-hydrogen systems, fundamentals and applications, Stuttgart (Germany, F.R.), 4-9 Sep 1988). Order Number DE90016712. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The results of nuclear magnetic resonance (NMR) studies at very high temperatures (up to 1000°C) on two classes of hydrogen-containing metallic systems – the Group III and IV transition metal dihydrides and the Group III and V metal solid solution phases – are summarized. Anomalous behavior of the nuclear spin-lattice relaxation rate has been found in all these systems at

temperatures above ~600 K. Various possible origins of the anomaly are reviewed, and its similarity to behavior found in fast-ion conductors is noted. 14 refs., 5 figs., 1 tab.

50075 (IS-M–639) **Nuclear magnetic resonance survey of hydrogen motion and electronic structure in α-phase (Nb-Mo)-H alloys.** Ibanez-Meier, R. (Ames Lab., IA (USA)); Torgeson, D.R.; Barnes, R.G. Ames Lab., IA (USA). [1990]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. (CONF-9009141–4: International symposium on metal-hydrogen systems, Banff (Canada), 2-7 Sep 1990). Order Number DE90018044. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The results of a proton nuclear magnetic resonance (NMR) survey of hydrogen motion and electronic structure in the solid solution (α) phase of niobium rich $Nb_{1-y}Mo_yH_x$ alloys are reported ($y \leq 0.2$, $x \leq 0.2$). Measurements of the temperature dependence of the proton spin-lattice relaxation time T_1 over the range $20 \leq T \leq 800$ K were analyzed to yield values of the activation energy E_a and jump attempt frequency ν_0 for hydrogen diffusive hopping and of the product $T_{1e}T = C_e$ indicative of the electronic density-of-states at the Fermi level, $N(E_F)$, where T_{1e} is that contribution to T_1. The T_1 vs T behavior shows features characteristic of hydrogen in random alloys, reflecting a distribution of E_a and ν_0 values. At high temperatures (~500 K), T_1 exhibits anomalous behavior, passing through a maximum and decreasing again at higher temperatures in the same manner found in the Nb–H and (Nb–V)-H systems. 10 refs., 2 figs.

50076 (IS-M–640) **Novel measurements of nuclear spin cross-relaxation in metal hydrides.** Baker, D.B. (Washington Univ., St. Louis, MO (USA). Dept. of Physics); Conradi, M.S.; Norberg, R.E.; Torgeson, D.R.; Barnes, R.G. Ames Lab., IA (USA). [1990]. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. (CONF-9009141–5: International symposium on metal-hydrogen systems, Banff (Canada), 2-7 Sep 1990). Order Number DE90018042. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Recent NMR measurements of proton relaxation have shown an unexpected frequency dependence in several metal-hydrogen systems at low temperatures. An explanation proposed by the Ames group involves cross-relaxation of protons to quadrupolar metal nuclei. We test this hypothesis with relaxation experiments involving large amplitude field modulation. The field modulation sweeps the proton resonance through the distribution of metal frequencies. Thus, the protons come into contact with more metal nuclei, increasing the proton relaxation rate. Relaxation measurements have been performed on several samples and the proton resonance frequency, the modulation frequency, and the modulation amplitude have been varied. Also to be reported are T_1 measurements on slowly spinning samples; the rotation produces periodic variations of metal quadrupolar frequencies.

50077 (IYaF–89-49) **On the electronic structure of high temperature superconductors: Nonalloyed CuOsub 2 plane.** Sushkov, O.P.; Flambaum, V.V. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1989. 15p. (In Russian). Order Number DE91600641. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The value of screened coulomb repulsion of copper 3d-electrons and oxygen 2p-electrons is calculated. With respect to the crystal field and correlation effects the spectrum of electron states in nonalloyed samples is found. It is shown that the correlation effects greatly increase the splitting of 2p-orbitals of oxygen. Evidently, the presence of the second oxygen peak in photoionization spectra located 4-5 eV deeper than the main one, is connected with this. The structure of the electron state of the alloyed sample greatly depends on the presence of this splitting. 15 refs.; 1 fig.

50078 (JINR–14-89-462) **Experimental studies of effect of high current pulse electron and carbon ion beams on high temperature Y-Ba-Cu-O, Bi-Ca-Sr-Cu-O superconductors.** Korenev, S.A.; Altynov, V.A.; Sikolenko, V.V.; Chernakova, A. Joint Inst. for Nuclear Research, Dubna (USSR). 1989. 15p. (In Russian). Order Number DE91600712. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Submitted to Sverkhprovodimost': Fiz., Khim., Tekh.

This work shows the results of the experiment on the effect of high current electron and carbon ion pulse beams irradiation on high-T_c superconductors Y-Ba-Cu-O and Bi-Ca-Sr-Cu-O in vacuum ($P \approx 5 \times 10^{-5}$ torr). The parameters of electron beam used in the experiment were: $E \approx 100$-300 keV, $j_e \approx 10$-1000 A/cm^2, $\tau_p \approx 300$ ns. The parameters of carbon ions used in the experiment were: $E \approx 100$-300 keV, $j_i \approx 1$-60A/cm^2, $\tau_p \approx 300$ns. The methods of irradiation and studies of bulk high-T_c superconductors characteristics are described. Pulse methods of critical current measurement were improved. Experiments had shown the threshold electron beam power density for surface melting in adiabatic heat condition for Y-Ba-Cu-O ceramics up to $P_0 \geq 10^7$ W/cm^2, and for Bi-Ca-Sr-Cu-O ceramics up to P_0 >or approx.4×10^6W/cm^2. Increasing of critical current in 2 times was observed in samples with a melting surface layer. The integral resistance of Y-Ba-Cu-O and Bi-Ca-Sr-Cu-O decreased in 2-2.5 times for electron beams irradiated samples and in 1.25-1.8 times for ion irradiated samples. Amorphization did not take place and stoichiometry remained after such irradiation. 13 refs.; 10 figs.; 4 tabs.

50079 (JINR-E–14-89-128) **Muon spin relaxation study of protonic superionic conductor $CsHSO_4$.** Belushkin, A.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics); Cox, S.F.J.; Eaton, G.H.; Scott, C.A.; Shuvalov, L.A. Rutherford Appleton Lab., Chilton (UK); Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics. 1989. 6p. Order Number DE91600642. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Submitted to J. Phys., C.

The protonic superionic conductor $CsHSO_4$ has been studied by μSR over the range of temperatures 15-440 K. The first successful observation of superionic phase transition by the μSR method is reported. A spasmodic change in relaxation rate and asymmetry was observed as the transition temperature was approached. There are no any remarkable differences in the relaxation rate between deuterated and protonated samples in the temperature range 15-290 K. Asymmetry revealed in isotope effect. The temperature dependence and isotope effect for asymmetry may testify the formation of muonium fraction in the sample. Together with the published NMR results the obtained μSR data confirm the fact that the high ionic conductivity in $CsHSO_4$ is the result of high monility of protons in a superionic phase. 9 refs.; 5 figs.

50080 (KIFVE–88-09) **Proceedings of the seminar of young scientists HEPI AN Kaz SSR. Part 2: 2. Solid state physics and mass transfer simulation.** AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. 44p. (In Russian). Order Number DE90706213. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Individual papers in scope for the data base are processed separately. (DLC)

50081 (KIFVE–88-09, pp. 11-16) **Hydrogen passivation of radiation-induced defects in silicon.** Abdullin, Kh.A.; Tashenov, T.B.; Tokmoldin, S.Zh. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. (In Russian). In *Proceedings of the seminar of young scientists HEPI AN Kaz SSR. Part 2: 2. Solid state physics and mass transfer simulation.* Order Number DE90706213. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Hydrogen passivation of radiation-induced defects in silicon in p-n transitions and the Schottky barrier is investigated by the method of non-stationary capasitive spectroscopy. Radiation-induced defects are introduced during structure irradiation by protons (30 MeV) and by α-particles (4.7 MeV). It is established that after treatment in hydrogen plasma there appears a large number of hydrogen atoms in specimens capable to passivation of all electrically active centers - both divacancies and carbon interstitials. This conclusion is confirmed by the data on thermal annealing. 1 ref.; 2 figs.

50082 (KIFVE–88-09, pp. 17-19) **Currents caused by radiation-induced defects in p-n junctions.** Bukharbaev, K.S.; Grishchenko, V.F.; Gurchenok, G.S. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. (In Russian). In *Proceedings of the seminar of young scientists HEPI AN Kaz SSR. Part 2: 2. Solid state physics and mass transfer simulation.* Order

Number DE90706213. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The results of investigation of the effect of radiation-induced defects, formed by argon ions with E=225 MeV, on the volt-ampere characteristic direct branch of silicon p-n transitions. It is established, that increase of direct current $\approx 10^3$ times at $U_d \simeq 0.2$ V (T=300 K) and $\approx 10^2$ time at $U_d \simeq 0.9$ V (T 77 K). The value of recombination parameter, m, after irradiation depends on voltage and changes from 1.2 to 2.3. The authors consider the phenomena observed to relate to the formation of inhomogeneities in the region of a special charge of p-n-transition and to the appearance of new current components.

50083 (KIFVE–88-09, pp. 20-25) **Investigation of radiation-induced defects in p-Si by deep level nonstationary capacitance spectroscopy method.** Abdullin, Kh.A.; Tashenov, T.B.; Chikhraj, E.V. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. (In Russian). In *Proceedings of the seminar of young scientists HEPI AN Kaz SSR. Part 2: 2. Solid state physics and mass transfer simulation.* Order Number DE90706213. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A spectrum of radiation-induced defects in silicon alloyed with boron, aluminium or gallium at n^+-p-transitions and the Schottky barriers is investigated by the method of non-stationary capcitive spectroscopy of deep levels. Three main bands corresponding to the states and transitions of divacancies and interstitial atoms of carbon in the region of high concentration of defects are detected in spectra obtained immediately after irradiation by high-energy particles (electrons, protons and α-particles) and after annealing at room temperature. Band amplitude dependences on onjection of auxiliary carriers, as well as stability of centers investigated during annealing are studied. 2 figs.

50084 (LA–11915-MS) **Secondary-electron yield measurements from metals impacted by high- velocity ions, electrons, and molecules.** Suszcynsky, D.M.; Borovsky, J.E.; Barraclough, B.L. Los Alamos National Lab., NM (USA). Sep 1990. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE90018023. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In support of several recent experiments, the Space Plasma Physics Group at Los Alamos National Laboratory has measured the secondary-electron yields from metals impacted by high-speed projectiles. Secondary-electron yields from gold, tantalum, and oxidized aluminum surfaces were measured using H^{+1}, H_2^{+1}, H_3^{+1}, $^3He^{+1}$, $^3He^{+2}$, $^4He^{+2}$, $^9Be^{+4}$, $^{10}B^{+5}$,$^{12}C^{+6}$, and $^{16}O^{+8}$ in projectiles in the 1- to 11-MeV/amu energy range. Measurements of secondary-electron yields from titanium, copper, molybdenum, silver, tantalum, gold, lead, uranium, oxidized aluminium, brass, stainless steel, and aquadag surfaces were made with 0.6- to 40-keV electrons provided by scanning electron microscopes at Los Alamos and at the University of Iowa. These measured yields are presented in tabular form. 15 refs., 1 figs., 7 tabs.

50085 (LBL–26455, pp. 81) **Quasiparticle calculation of valence-band offset of AlAs-GaAs(001).** Zhang, S.B.; Tomanek, D.; Louie, S.G.; Cohen, M.L.; Hybertsen, M.S. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A first-principles quasiparticle theory for band offsets of heterojunctions is developed and used to compute the valence band offset ΔE_v for the prototypical AlAs-GaAs(001) interface. The result, $\Delta E_v = 0.53 \pm 0.05$ eV, is in good agreement with recent experimental values and in particular with the most recent photoluminescence data, $\Delta E_v = 0.56 \pm 0.03$ eV, for a sample grown by molecular-beam epitaxy. The authors show that there is a substantial many-body correction of 0.12 eV to the value of the valence-band offset calculated using local-density functional theory.

50086 (LBL–26455, pp. 218) **Novel properties of matter at megabars of pressure.** Cohen, M.L.; Jeanloz, R.; Yu, P.Y. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The purpose of this research project is to investigate the properties of matter at megabars of pressure both experimentally and theoretically. The objective is to combine the expertise of experimentalists and theorists in the area of high-pressure technology, materials characterization techniques, inorganic synthesis, and theoretical computation of properties of matter to synthesize and investigate new materials with unusual properties or with potential applications to energy technology. Examples of these new materials are ultrahard solids with strength comparable to or exceeding that of diamond, and solids with unusual electrical, superconducting, optical, and magnetic properties. What distinguishes this project from other high-pressure projects is the close interaction between the theoretical group of Marvin Cohen and the two experimental groups under Raymond Jeanloz and Peter Yu. The theoretical group uses the ab initio pseudopotential method to calculate the ground-state properties of solids as a function of volume. The theoretical predictions are tested by experiments performed by the Yu and Jeanloz groups. These two investigators have broad experience in materials science and with a wide range of high-pressure techniques, such as high-temperature synthesis of inorganic materials, x-ray crystallography, Raman and emission spectroscopies, Fourier-transform infrared spectroscopy, and low-temperature electrical-transport measurements.

50087 (NIFS-DATA–1) **Data compilation of angular distributions of sputtered atoms.** Yamamura, Yasunori; Takiguchi, Takashi; Tawara, Hiro. National Inst. for Fusion Science, Nagoya (Japan). Jan 1990. 219p. Order Number DE90520450. Source: NTIS (US Sales Only), PC A10/MF A01.

Sputtering on a surface is generally caused by the collision cascade developed near the surface. The process is in principle the same as that causing radiation damage in the bulk of solids. Sputtering has long been regarded as an undesirable dirty effect which destroys the cathodes and grids in gas discharge tubes or ion sources and contaminates plasma and the surrounding walls. However, sputtering is used today for many applications such as sputter ion sources, mass spectrometers and the deposition of thin films. Plasma contamination and the surface erosion of first walls due to sputtering are still the major problems in fusion research. The angular distribution of the particles sputtered from solid surfaces can possibly provide the detailed information on the collision cascade in the interior of targets. This report presents a compilation of the angular distribution of sputtered atoms at normal incidence and oblique incidence in the various combinations of incident ions and target atoms. The angular distribution of sputtered atoms from monatomic solids at normal incidence and oblique incidence, and the compilation of the data on the angular distribution of sputtered atoms are reported. (K.I.).

50088 (UCRL-JC–103948) **MONT3E: A Monte Carlo electron heat transfer code.** Maltby, J.D.; Kornblum, B.T. Lawrence Livermore National Lab., CA (USA). Apr 1990. 29p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-901121–3: Association for Computing Machinery/Institute of Electrical and Electronics Engineers supercomputing conference, New York, NY (USA), 12-16 Nov 1990). Order Number DE90012091. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A Monte Carlo code, MONT3E, was written to analyze heat transfer due to electron backscattering. The availability of supercomputers has made large-scale applications of this analysis technique possible. Statistically valid solutions of complicated engineering problems can now be performed. In this paper, the physical theory of electron trajectories is described and related to the implementation of an electron tracing algorithm. The analysis requires three types of information: a geometric description of the enclosed volume under analysis, magnetic field definition, and a model of electron-surface interaction. The implementation of these three components in MONT3E is presented. Suitability of the formulation to various computer architectures is discussed. An electron backscatter experiment was modeled using the code. The MONT3E predictions compared favorably to the experimental data, lending confidence to code predictions. Additional information available in the simulations provided new physical insights into the electron experiment. Comparison with the analytic solution to a related problem is also presented. 12 refs., 15 figs.

6561 Superconductivity

Refer also to citation(s) 48889, 48901, 48905, 48910, 48911, 48917, 48920, 48921, 48923, 48924, 48927, 48928, 48930, 48932, 48934, 48935, 48965, 49210, 50077

50089 (ORNL/FTR–3724) **[19th international conference on low-temperature physics]: Foreign trip report, August 15–25, 1990.** Kerchner, H.R. Oak Ridge National Lab., TN (USA). 10 Sep 1990. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90017503. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler attended the 19th International Conference on Low-Temperature Physics providing him with an intensive overview of much of the research effort in low-temperature physics. Roughly one-half of the total number of conference presentations were talks and posters on the properties of high-temperature superconductors. At the conference, as well as during visits to the University of Cambridge and the University of Birmingham, the traveler was able to discuss technical details of numerous research topics with the individuals directly involved.

6570 Theoretical and Mathematical Physics

Refer also to citation(s) 48986, 49032, 49129, 49219, 49749, 49810, 49919

50090 (BARC–1479) **Manifolds, tensors and differential forms: some applications in physics.** Datta, S. (Bhabha Atomic Research Centre, Bombay (India). Theoretical Physics Div.). Bhabha Atomic Research Centre, Bombay (India). 1989. 49p. Order Number DE91600476. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The style of mathematics used in contemporary physics has evolved considerably during the last twentyfive years. Groups, topology and differential geometry have become an intergral part of the physicist's jargon in their attempt to express the laws of the nature in lucid and compact terms. The notes prepared are based on the lectures given by the author in the Mathematics Seminar of the Theoretical Physics Division in the latter half of 1985. These lecture notes contain an introduction to manifolds and differential forms in the most succinct manner that is possible. It is essentially an attempt to familiarise the reader with the requisite vocabulary in this area of mathematical physics without scaring them with excess of rigour. This hopefully will help in following the contemporary literature in physics. (author). 6 refs.

50091 (DOE/ER/13846–3) **Mathematical models of hysteresis: Progress report, January 1990–December 1990.** Mayergoyz, I.D. Maryland Univ., College Park, MD (USA). Dept. of Electrical Engineering. Aug 1990. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER13846. Order Number DE90017840. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Short communication. HYSTERESIS/mathematical models; PROGRESS REPORT; HYSTERESIS; MAGNETIC FIELDS

50092 (FRNC-TH–3538) **Convergence of numerical schemes suitable for two dimensional nonlinear convection: application to the coupling of modes in a plasma.** Boukadida, T. Bordeaux-1 Univ., 33 (France). 1988. 160p. (In French). Order Number DE91700560. Source: NTIS (US Sales Only), PC A08/MF A01.

The compatibility between accuracy and stability of the quasilinear equations is studied. Three stuations are analyzed: the discontinuous P-1 approximation of the first order quasilinear equation, the two dimensional version of the Lax-Friedrichs scheme and the coupling of modes in a plasma. For the one dimensional case, the proposed scheme matches the available data. In the two dimensional case, tests to show the explosion condition are performed. This investigation can be applied in laser-matter interactions, nonlinear optics and in many fields of physics.

50093 (IAE–4757-1) **Synthesis of oneparticle excitation from two giant quantum monopoles.** Shishkov, S.Yu. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 3p. (In Russian). Order Number DE91600481. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Within the framework of the two-dimensional quantum hydrodynamics of an incompressible homogeneous ideal fluid the hypothesis on the existence of the quantum point vortex (monopole) is suggested. It is shown that if this hypothesis is valid, then one-particle excitation, which was through of as indivisible earlier, is monopole+antimonopole pair bound state. 4 refs.

50094 (IFUSP-P–800) **Functionals Hartree-Fock equations in the Schrodinger representation of quantum field theory.** Gamboa, J. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Aug 1989. 8p. Order Number DE91600482. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Hartree-Fock equations for a scalar field theory in the Schrodinger representation are derived. It is shown that renormalization of the total energy in the functional Schrodinger equation is enterely contained in the eigenvalues of the Hartree-Fock hamiltonian. (A.C.A.S.).

50095 (IFUSP-P–836) **Quantum mechanics of relativistic particles in multiply connected spaces and the Aharonov-Bohm effect.** Gamboa, J. (Centro de Estudios Cientificos de Santiago, Santiago (Chile)); Rivelles, V.O. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. Apr 1990. 11p. Order Number DE91600483. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

We consider the motion of free relativistic particles in multiply connected spaces. We show that if one of the spatial dimensions has the topology of a circle then the D dimensional spacetime is compactified to D-1 dimensions and the particle mass increases by an amount which is proportional to a quantum phase factor and inversely proportional to the radius of the circle. We also consider the relativistic Aharonov-Bohm effect and we show that the interference pattern is a universal characteristic due only to the topological properties of the experimental situation and not to the intrinsic properties of the particle. The propagators are calculated in both situations. (author).

50096 (IFVE-OTF–89-80) **On integrating of a singular integro-differential equation.** Leznov, A.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 4p. (In Russian). Order Number DE91600477. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The solution of an integro-differential equation with the Cauchy core is reduced to a uniform Riemann conjugacy problem with the matrix coefficient, being a preset function of the initial value and parameter g. 4 refs.

50097 (IS-M–643) **Elementary inversion, energy velocity, and a generalized Sommerfeld theorem.** Roberts, T.M.; Hobart, M. Ames Lab., IA (USA). [1990]. 10p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Contract N0014-83-K-0038. (CONF-900756–41: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90018046. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We will do three things: show how to infer elementarily from time-domain precursors some frequency-domain information. Second, make observations on energy velocity that may be surprising. Third, generalize Sommerfeld's theory about the speed of light.

50098 (ITEF–93-89) **Quantization with acount of barrier permeability.** Mur, V.D.; Popov, V.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1989. 32p. (In Russian). Order Number DE91600486. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A correction to the Bohr-Sommerfeld quantization rules connected with the final barrier permeability (for quasistationary states) is obtained. The analytical continuation of quantization conditions in the superbarrier region is discussed. The results obtained are illustrated using the example of a exactly solvable model, as well as for the stark effect in a strong field. 27 refs.; 3 figs.

50099 (JINR-R-2-89-182) **The energy problem in GR and tensor analysis.** Chernikov, N.A. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1989. 12p. (In Russian). Order Number DE91600504. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The object well-known in geometry, tensor of affine deformation, was from the very beginning lost in the general relativity (GR). This carelessness, having put tensor analysis in a bad light, generated a pseudotensor subculture that was crowned with pseudotensor energy of the gravitational field. The meaning of a substitute for the tensor energy has been discussed for more than seventy years. Introduction of a lost tensor into RG allows one to construct on the basis of the tensor analysis the gravity theory without any substitutes and to finally solve the energy problem of the gravitational field. 53 refs.

50100 (JINR-R-2-89-224) **Tensor lost in general relativity theory.** Chernikov, N.A. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1989. 7p. (In Russian). Order Number DE91600505. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

In the tensor gravity theory developed in this paper two tensor fields $g^{ab}=g^{ba}$ and $P_{mn}{}^{a}=P_{nm}{}^{a}$ are in the foreground. The first field defines the Christoffel connection $\Gamma_{mn}{}^{a}$ and the second one defines the background connection $\Gamma_{mn}{}^{a}$. They are used to express algebraically the energy tensor linear in g^{ab} and quadratic in $P_{mn}{}^{a}$. If the curvature tensor of the background connection is everywhere zero, the tensor gravity theory transforms into the Einstein theory so that a new theory satisfies the correspondence principle. A case of semiprimitive background connection is separated. A tensor lost in the general relativity is the known in geometry tensor of the affine deformation $P_{mn}{}^{a}=\Gamma_{mn}{}^{a}-\Gamma_{mn}{}^{a}$. 5 refs.

50101 (JINR-R-11-89-188) **Solution of eigenvalue problem for one class of hypersingular quasipotential integral equations.** Zhidkov, E.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation); Khoromskij, B.N.; Nikonov, Eh.G. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation. 1989. 22p. (In Russian). Order Number DE91600487. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Submitted to Mat. Modelirovanie.

Spectral properties of one class of hypersingular operators on semiaxis are investigated. Estimates of approximation errors by the Galerkin methods are obtained in the eigenvalues problem for these operators. The results of numerical calculations for model problems are given. 27 refs.; 3 tabs.

50102 (KFTI-88-36) **Some dynamical properties of the linear three-particle chain.** Bolotin, Yu.L.; Gonchar, V.Yu.; Chekanov, N.A. AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst. 1988. 5p. (In Russian). Order Number DE91600488. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

In one of Lunsford and Ford papers it was stated that Hamiltonian of three-particle system $H = 1/2(P_1^2 + P_2^2 + P_3^2) + V(x_1 - x_2) + V(x_2 - x_3) = V(x_3 - x_1)$ in a cubic approximation is reduced to the known Henon-Heyles Hamiltonian. In the present paper it is shown that the above-mentioned result is valid only to invariant relatively C_{3v} discrete group Hamiltonians. Hamiltonian of such system may be represented as a power series each member of which is represented in terms of two invariants of C_{3v} group. 11 refs.

50103 (LA-UR-90-1845) **Random number stride in Monte Carlo calculations.** Hendricks, J.S. Los Alamos National Lab., NM (USA). [1990]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-901101-4: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE90012000. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Monte Carlo radiation transport codes use a sequence of pseudorandom numbers to sample from probability distributions. A common practice is to start each source particle a predetermined number of random numbers up the pseudorandom number sequence. This number of random numbers skipped between each source particles the random number stride, S. Consequently, the jth source particle always starts with the j-Sth random number providing "correlated sampling" between similar calculations. A new machine-portable random number generator has been written for the Monte Carlo radiation transport code MCNP providing user's control of the random number stride. First the new MCNP random number generator algorithm will be described and then the effects of varying the stride will be presented. 2 refs., 1 fig.

50104 (RFP-4418) **Anecdotal history of acoustic emission from wood.** Drouillard, T.F. EG and G Rocky Flats, Inc., Golden, CO (USA). Rocky Flats Plant. 16 Jul 1990. 22p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. (CONF-901176-1: 34. acoustic emission working group meeting, Urbana, IL (USA), 12-15 Nov 1990). Order Number DE90014471. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The development of acoustic emission technology has primarily been with metals, and more recently with composites. Currently there is a growing interest in the study of acoustic emission from wood. This has led to the preparation of a special bibliography of AE literature on wood by T. F. Drouillard and F. C. Beall, which in turn, prompted a look into the history of acoustics associated with wood, wood products, and wooden structures. Little historical material and relatively few publications were found on the subject. This article presents a historical review on the dearth of information that could be found – from the reports of miners relying on the audible sounds from mine support timbers providing a warning of impending failure and the beginnings of the study and documentation of acoustic emission from wood, starting with experiments reported as early as 1934 by F. Kishinouye in Japan, up to the introduction of fracture mechanics of wood in 1964 by A. W. Porter – all collated into the general history of acoustic emission. Included are a number of anecdotes relative to the history of sound and acoustic emission.

50105 (RRK-90-9) **Correlation function of gravitational deflection angles of light paths.** Watanabe, Kazuya; Tomita, Kenji. Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics. Apr 1990. 16p. Order Number DE90520328. Source: NTIS (US Sales Only), PC A03/MF A01.

The correlation function of gravitational deflection angles of light paths is investigated in a simplified cosmological model universe. Under several reasonable assumptions, an analytic formula for the correlation function is derived. The implication to the cosmic microwave background anisotropy and the distance defined by the observed angular (linear) scale of a source is also discussed. (author).

50106 **General relativistic hydrodynamics and radiation transport.** Bludman, S.A. (Pennsylvania Univ., Philadelphia, PA (USA). Dept. of Physics); Schinder, P.J. pp. 265-275 of Proceedings of the fourteenth Texas symposium on relativistic astrophysics. Fenyves, E.J. The New York Academy of Sciences, New York, NY (USA) (1989). (CONF-881268-: 14. Texas symposium on relativistic astrophysics, Dallas, TX (USA), 11-16 Dec 1988).

The authors have developed an implicit hydrodynamics code in polar-sliced comoving coordinates that, because it is regular everywhere outside the apparent horizon, completely covers the space-time domain of outer communication, gives maximum coverage of material zones, and allows calculation through many time steps of dynamic and of quasi-static evolution. In the same polar-sliced comoving gauge, they wrote down the general relativistic transport equation and moment equations and solved for the variable Eddington factor by the generalization of the tangent-ray method used in nonrelativistic transport theory. The authors have calculated the stationary transport in a weak and strong static gravitational field and found that gravity enhances the optical thickness and leads to a moderate reduction in the forward-peaking of the radiation field in an extended spherical atmosphere, and redshifts the luminosity and mean intensity, as expected.

50107 **A new field experiment in the Greenland ice cap to test Newton's inverse square law.** Ander, M.E. (Los Alamos National Lab., NM (USA)); Nieto, M.M.; Zumberge, M.A.; Parker, R.L.; Lautzenhiser, T.; Aiken, C.L.V.; Ferguson, J.F.; McMechan, G.A. pp. 672-680 of Proceedings of the fourteenth Texas symposium on relativistic astrophysics: Volume 571. Fenyves, E.J. The New York

Academy of Sciences, New York, NY (USA) (1989). (CONF-881268–: 14. Texas symposium on relativistic astrophysics, Dallas, TX (USA), 11-16 Dec 1988).

Recent experimental evidence suggests that Newton's law of gravity may not be precise. There are modern theories of quantum gravity that, in their attempts to unify gravity with other forces of nature, predict non-Newtonian gravitational forces that could have ranges on the order of 10^2–10^5 m. If they exist, these forces would be apparent as violations of Newton's inverse square law. A geophysical experiment was carried out to search for possible finite-range, non-Newtonian gravity over depths of 213–1673 m in the glacial ice of the Greenland ice cap. The principal reason for this choice of experimental site is that a hole drilled through the ice cap already existed and the uniformity of the ice eliminates one of the major sources of uncertainty arising in the first of earlier studies, namely, the heterogeneity of the rocks through which a mine shaft or drill hole passes. This paper presents observations made in the summer of 1987 at Dye 3, Greenland, in the 2033-m-deep borehole, which reached the basement rock.

70 FUSION ENERGY

Refer also to citation(s) 48624

50108 (AD-A-222719/7/XAB) **Analysis of the published calorimetric evidence for electrochemical fusion of deuterium in palladium. Technical report.** Miskelly, G.M.; Heben, M.J.; Kumar, A.; Penner, R.M.; Sailor, M.J. California Inst. of Tech., Pasadena, CA (USA). Dept. of Chemistry. 10 Nov 1989. 7p. Contract N00014-88-K-0482. (TR–8). Source: NTIS, PC A02/MF A01.

Pub. in Science, Vol. 246, 793-796(10 Nov 1989).

Estimates are given of the raw data that are the basis for the claims of excess power production by the electrochemical charging of palladium in deuterium oxide (D2O). Calorimetric results are also presented that show no anomalous power production in either 0.1 M LiOD/D2O or 0.1 M LiOH/H2O (LiOH is lithium hydroxide). Several possible sources of error in open-system calorimetry are discussed that can confound interpretation of temperature changes in terms of anomalous power production.

7001 Plasma Research

Refer also to citation(s) 48998, 49223, 49302, 49327, 49876, 49895, 50092

50109 (BARC–1489) **Particle simulation of a two-dimensional electrostatic plasma.** Patel, K. (Bhabha Atomic Research Centre, Bombay (India). Multidisciplinary Research Scheme). Bhabha Atomic Research Centre, Bombay (India). 1989. 58p. Order Number DE91600853. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

Computer simulation is a growing field of research and plasma physics is one of the important areas where it is being applied today. This report describes the particle method of simulating a two-dimensional electrostatic plasma. The methods used to discretise the plasma equations and integrate the equations of motion are outlined. The algorithm used in building a simulation program is described. The program is applied to simulating the Two-stream Instability occurring within an infinite plasma. The results of the simulation are presented. The growth rate of the instability as simulated is in excellent agreement with the growth rate as calculated using linear theory. Diagnostic techniques used in interpreting the data generated by the simulation program are discussed. A comparison of the computing environment of the ND and PC from a user's viewpoint is presented. It is observed that the PC is an acceptable computing tool for certain (non-trivial) physics problems, and that more extensive use of its computing power should be made. (author). 5 figs.

50110 (CEA-CONF–9884) **Satellite lines of neon-like resonance lines for 17<Z<48.** Jacquemot, S. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (FR)); Louis-Jacquet, M.; Peyrusse, O.; Cornille, M.; Dubau, J.; Lautard, P. CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France). 1988. 8p. (CONF-880955–: International conference on the physics of multiply charged ions and international workshop on E.C.R. ion sources, Grenoble (France), 12-16 Sep 1988). Order Number DE91700544. Source: NTIS (US Sales Only), PC A02/MF A01.

The dielectronic satellite lines of the neon-like resonance lines $1s^22s^22p^5 3d$ - $1s^22s^22p^6$ have been observed in the spectra obtained during the Limeil X-ray Laser experiments under collisional dense plasma conditions ($10^{20}<n_e<10^{21}cm^{-3}$,$T_e$=600eV) for Cu, Ge, Se, Mo and Ag.We present here the theoretical calculations of dielectronic recombination rate coefficients for neon-like ions to form sodium-like ions. The atomic parameters required are energy levels, wavelengths, radiative and autoionization probabilities. The quantities are calculated with two coherent codes SUPERSTRUCTURE and AUTOLSJ.

50111 (CEA-CONF–9885) **Supersonic jets of cylindrical metallic plasma shells as imploding loads in high-power dense Z-pinch.** Doucet, H.J. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (FR)); Buzzi, J.M.; Rehel, C. CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France). 1988. 7p. (CONF-8810526–: Conference on Z-Pinch and Plasma Focus, Nice (France), 10-11 Oct 1988). Order Number DE91700542. Source: NTIS (US Sales Only), PC A02/MF A01.

For very rapid (0.5-lμs) Joule heating of a conducting metallic foil, in which the temperature rises before the liquid foil has the time to expand, it can be expected that the mechanical inertia of the foil could cause the internal pressure to increase to sufficiently large values to bypass the critical point (P_c,T_c), allowing a continuous transition from the liquid to the gas phase, without any boiling. In order to illustrate this effect and to understand if such a situation can really occur in a real foil explosion experiment, the case of sodium foils is studied here using an analytical approach. For simplicity, we assume a uniform temperature in the foil, and we neglect radiation and evaporative mass losses. The foil expansion is represented by a self-similar model. The pressure is governed by the foil inertia and is obtained from the known values of the bulk modulus and the density variations as a function of the temperature. In spite of the oversimplified character of the used model, the possibility to overpass the critical point is obtained for the parameters which were found to yield experimentally a well-defined uniform plasma from thin Na and Al foils explosions.

50112 (CONF-901025–6) **Edge turbulence and transport: Text and ATF modeling.** Ritz, C.P. (Texas Univ., Austin, TX (USA). Fusion Research Center); Rhodes, T.L.; Lin, H.; Rowan, W.L.; Bengtson, R.; Wootton, A.J.; Carreras, B.A.; Leboeuf, J.N.; Lee, D.K.; Harris, J.; Hidalgo, C.; Bell, J.D.; Holmes, J.A.; Isler, R.; Lynch, V.E.; Uckan,Oak Ridge National Lab., TN (USA). [1990]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. (IAEA-CN–53/C-3-4). From 13. international conference on plasma physics and controlled nuclear fusion research; Washington, DC (USA); 1-6 Oct 1990. Order Number DE90017326. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We present experimental results on edge turbulence and transport from the tokamak TEXT and the torsatron ATF. The measured electrostatic fluctuations can explain the edge transport of particles and energy. Certain drive (radiation) and stabilizing (velocity shear) terms are suggested by the results. The experimental fluctuation levels and spectral widths can be reproduced by considering the nonlinear evolution of the reduced MHD equations, incorporating a thermal drive from line radiation. In the tokamak limit (with toroidal electric field) the model corresponds to the resistivity gradient mode, while in the currentless torsatron or stellarator limit it corresponds to a thermally driven drift wave.

50113 (CTH-IEFT-PP–1990-03) **Prestudy of burn control in NET: Second intermediate report, February 1990.** Anderson, D. (Chalmers Univ. of Tech., Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics); Hamnen, H.; Lisak, M.; Elevant, T.; Lorenzen, J.; Persson, H. Chalmers Univ. of Tech., Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics. Feb 1990. 71p. Order Number DE90638959. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

The present report describes our ongoing work on a number of selected topics, and the plans for the near future. In chapter 2 we

have specialized the system of the previous report to form an easily tractable, second-order system. In this case one can give an explicit, analytical condition for stability. A code providing quick answers regarding stability, time scales and eigenvectors has been written and tested. The zerodimensional modelling of a burning plasma described by space dependent equations is often done in a heuristic way, with no clear relation between the two systems of equations. We have tried to put the approximation procedure involved in the transition to 0-D models on a more formal basis. This is the topic of chapter 3. The 1-D equilibrium solution is also investigated with respect to its stability properties, which are shown to be the same as those derived from the simplest 0-D space averaged model. Chapter 4 contains a few emerging thoughts on burn control. First, the limited swing of the auxiliary heating gives rise to limitations on the possibilities to intervene against temperature excursions by an auxiliary heating modulation. This problem becomes severe when one operates at high Q values. Another analysis concerns the problem of selecting a proper control action when a temperature profile differs from the equilibrium shape. A couple of alternative schemes for burn control, minor radius alterations and dynamic stabilization are tentatively discussed; no definite answers on their feasibility are obtained. The problem of diagnosing the plasma with respect to burn conditions is the topic of chapter 5. The influence on the energy distribution of control actions and the reliability of neutron measurements are discussed, and the question of how to handle sawteeth is briefly revisited. Chapter 6 is a description of process identification and how it could be used for burn control. (Abstract Truncated)

50114 (DOE/ER/52127–72) **CTR plasma engineering studies: Annual progress report, December 1, 1989–November 30, 1990.** Miley, G.H. Illinois Univ., Urbana, IL (USA). Dept. of Nuclear Engineering. [1990]. 26p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER52127. Order Number DE90017774. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The main focus of the work by the Fusion Plasma Engineering Group at the University during the prior contract year involved a study of fusion ash (helium) effects on burn efficiency and on potential ways to control ash buildup. This work has wide application to a variety of fusion reactor concepts, but the immediate application for the present work is in the ARIES tokamak reactor design study now being undertaken by a national design team headed by the UCLA. The examples presented here largely deal with the ARIES-I design which is a D-T device operating in the first instability regime.

50115 (DOE/ER/53198–160) **Confinement and fluctuations in the MST [Madison Symmetric Torus] reversed field pinch.** Sprott, J.C.; Almagri, A.F.; Assadi, S.; Beckstead, J.A.; Chartas, G.; Dexter, N.; Den Hartog, D.J.; Hokin, S.A.; Holly, D.J.; Prager, S.C.; Rempel, T.D.; Sarff, J.S.; Scime, E.; Shen, W.; Spragins, C.W.; Watts, C. Wisconsin Univ., Madison, WI (USA). Plasma Physics Research. Sep 1990. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER53198. (CONF-901025–7: 13. international conference on plasma physics and controlled nuclear fusion research, Washington, DC (USA), 1-6 Oct 1990; IAEA-CN–53/C-2-2-(2)). Order Number DE90018019. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

MST is a large (R_0/a = 1.5/0.52 m) RFP which to date has obtained 80 ms discharges at a peak plasma current of 0.6 MA. Low loop voltages (15 volts) and modest temperatures ($T_e/T_i \approx$ 350/250 eV) are routinely obtained giving estimated unoptimized energy confinement times of about 1 ms. Loop voltage and ion temperature are anomalous. Magnetic fluctuations are typically 0.5% with most of the power at frequencies below 30 kHz and mode numbers in agreement with MHD prediction for tearing modes. Electrostatic fluctuations are typically 10 to 20% with a spectrum that decreases with frequency. 5 refs., 2 figs.

50116 (DOE/ER/53240–3) **Theoretical and numerical studies in magnetic mirror fusion: Progress report.** Yale Univ., New Haven, CT (USA). [1990]. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER53240. Order Number DE90017605. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

It is proposed to investigate the dependence of neo-classical transport on aspect ratio and on the structure of the magnetic surfaces for general collisionality by use of relaxation models for collisions for a general mixture of electrons and ions. An optimum relaxation frequency will be determined for each transport coefficient by fitting those limiting results available. Simple models of turbulent transport will be added. A general purpose code will be developed, including the resulting transport equations, and made accessible to the fusion community. The results of this code his will be compared with known results. The solutions using the simple relaxation model will be compared with the counterpart results to be obtained by using a Lorentz model for collisions.

50117 (DOE/ER/53297–2) **High beta and confinement studies on TFTR: Progress report, September 25, 1989–May 24, 1990.** Columbia Univ., New York, NY (USA). Dept. of Applied Physics and Nuclear Engineering. [1990]. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER53297. Order Number DE90017722. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

In the first 8 months of this project we have made substantial progress toward the goals set out in our original proposal. Our plan to access new regimes of operation at high values of $\varepsilon\beta_p$ using low current discharges in TFTR has worked extremely well and a new regime of operation has indeed been found in the course of our execution of TFTR Experimental Proposal 146 which involved our operation of TFTR on 9 November 1989, 19–20 January 1990 and 1–2 February 1990. The status of our high $\varepsilon\beta_p$ work on TFTR is given and is extracted from our paper submitted for presentation to the 1990 EPS meeting in Amsterdam. We have also performed an analysis of the energetic particle stabilization requirements for TFTR Supershots, and developed methods for analysis and a theory of perturbative transport measurements in TFTR.

50118 (DOE/ET/53088–447) **Natural current profiles in a tokamak.** Taylor, J.B. Texas Univ., Austin, TX (USA). Inst. for Fusion Studies. Aug 1990. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-80ET53088. (IFSR–447). Order Number DE91000128. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

In this paper I show how one may arrive at a universal, or natural, family of Tokamak profiles using only accepted physical principles. These particular profiles are similar to ones proposed previously on the basis of ad hoc variational principles and the point of the present paper is to provide a justification for them. However in addition, the present work provides an interesting view of Tokamak fluctuations and leads to a new result – a relationship between the inward particle pinch velocity, the diffusion coefficient and the current profile. The basic Tokamak model is described in this paper. Then an analogy is developed between Tokamak profiles and the equilibrium of a realisable dynamical system. Then the equations governing the natural Tokamak profiles are derived by applying standard statistical mechanics to this analog. The profiles themselves are calculated and some other results of the theory are described.

50119 (DOE/ET/53088–451) **Effects of compressibility, diamagnetic drift, and thermal conduction on resistive ballooning modes in the second stability regime.** Kim, Jin-Yong; Choi, D.I.; Van Dam, J.W.; Horton, W. Texas Univ., Austin, TX (USA). Inst. for Fusion Studies. Aug 1990. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-80ET53088. (IFSR–451). Order Number DE90017618. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The stabilizing effects of various terms such as compressibility, diamagnetic drift, and parallel thermal conduction are investigated on the type of resistive ballooning modes whose driving force comes from the resistive region, which are known to be unstable in the high-beta second stability regime when analyzed in the incompressible limit. We find that compressibility gives a significant stabilizing effect mainly through the perpendicular magnetic compression, which suggests the possibility of a second stable window for these resistive ballooning modes. The diamagnetic drift terms slightly reduce the growth rate in the incompressible limit, but, with finite compressibility, lead to fairly strong stabilization. The compression due to ion polarization, which becomes significant at large

diamagnetic drift, contributes to this stabilization. On the other hand, parallel thermal conduction and perpendicular magnetic compression, which enter through the equation for temperature evolution, are shown to have a negligible effect on the stability of these modes.

50120 (DOE/OR/00033–T445) **Variable eigenmode excitation in the beach heating of two-ion-species mirror plasmas.** Roberts, D.R. Wisconsin Univ., Madison, WI (USA). 1990. 206p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-76OR00033. Order Number DE90017511. Source: NTIS, PC A10/MF A01; OSTI; INIS; GPO Dep.

Variable eigenmode excitation scans of the ion species ratio of hydrogen-helium and hydrogen-deuterium plasmas has been examined in the bench-heating configuration of the Phaedrus-B central cell. m = −1 fields were selectively excited by a "rotating-field" antenna array at ω/Ω_H = 0.8. The coupled wave energy propagates through a steep axial magnetic gradient into a region of strong ion-cyclotron resonance absorption which is located Δ z = 50cm from the antenna. Evidence of varied fast- and slow-wave eigenmode excitation and absorption, including variations in the radial profiles of waves magnetic field and plasma parameters, was observed during the scans. Optimal peak parameters in the plasma core, n_e = 1.0 × $10^{13}cm^{-3}$, $T_{e\|}$ = 20eV, $T_{i\|}$ = 140eV, $T_{i\perp}$ = 450eV, and β = 0.2, were obtained for moderate helium or deuterium ion fractions (puffed $n_{He}/n_e = n_D/n_e \sim 0.25$). These parameters exceed those obtained under the same conditions with "pure" hydrogen plasmas: n_e = 7.0 × $10^{12}cm^{-3}$, $T_{e\|}$ = 25eV, $T_{i\|}$ = 80eV, $T_{i\perp}$ = 300eV, and β = 0.1. These variations are in agreement with those expected from antenna-eigenmode coupling considerations.

50121 (EUR-CEA-FC–1359) **Diagnosis of superthermal electrons using cyclotron radiation.** Fidone, I.; Giruzzi, G. Association Euratom-CEA, Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherches sur la Fusion Controlee. Jun 1989. 31p. Source: NTIS (US Sales Only), PC A03/MF A01.

Selective electron-cyclotron emission and absorption by fast electron tails are discussed using the concepts of momentum-space spectra and collective resonance velocity. This is defined from the maximum of the emission and absorption profiles in the momentum space for a system of electrons and represents the counterpart of the one-particle resonance velocity. It is shown that the collective resonance is sensitive to the superthermal momentum distribution and is therefore a useful parameter in the diagnosis of the fast electron tail. A simple relation between the collective resonance and the emission and absorption coefficients for propagation normal to the magnetic field is found. This theoretical framework is used for a new diagnostic method based on the localized (in phase space) perturbation of the electron tail by an electron-cyclotron wave and emission and transmission of radiation at higher harmonics. A numerical application is presented for the case of a lower-hybrid sustained tail, using the appropriate Fokker-Planck and ray-tracing codes.

50122 (IAE–4740-6) **Kinetic limitations on sausage compression of Z-pinches.** Filippov, D.V.; Yan'kov, V.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1988. 5p. (In Russian). Order Number DE91600854. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

It was shown tha accounting thermal drifts results in a loss of particles and weakens sausage stabilization. A vortex equation was written, describing a motion in the pinch corona. 9 refs.

50123 (IAE–4756-6) **Nonlinear development of two-dimensional axial-symmetric MGD instability in a Z-pinch.** Kolkunov, B.O.; Solov'ev, L.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 24p. (In Russian). Order Number DE91600855. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Plasma dynamics at the final stage of compression in Z-pinch-type installations is considered in terms of classical single-liquid MHD. The development of an exisymmetric instability from an initially equilibrium cylindrical configuration is initiated by a plasma velocity perturbation. The equilibria studied constitute a uniparametric family with various instability growth rates. The nonlinear development of the instability results in a transition to quasiequilibrium at the boundary of stability, the equilibrium being determined by the initial-state parameters. The transition is accompanied by a total current drop. 18 refs.; 10 figs.; 2 tabs.

50124 (IAE–4767-6) **Gas jet magnetic compression dynamics.** Gasilov, V.A.; Grigor'ev, S.F.; Zakharov, S.V.; Krukovskij, A.Yu.; Skorovarov, S.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 16p. (In Russian). Order Number DE91600765. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Magnetic compression of helium jets has been mathematically simulated taking into account the possibility of existence of a rare corona around the jets and an external longitudinal magnetic field. The existence of the corona and external magnetic field is shown to result in reducing the liner aspect ratio. 19 refs.; 10 figs.

50125 (IAE–4775-8) **Possibility of using first collision probability method for solution of the problem of photon transport.** Fedulov, M.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 15p. (In Russian). Order Number DE91600764. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The possibility of using the probability first collision method to solve the problems of photon transport in a hot plasma is studied. The precision of the approximation envisaging flux isotropy at conventional boundaries between separate plasma zones (regions) is estimated. For line radiation in the approximated version of the method it is assumed that the spectrum of photons entering the zone coincides with the profile of lines in it. 5 refs.; 4 figs.

50126 (IAE–4784-7) **Thomson scattering equipment for investigation of plasma filament scrape-off layer at the T-10 tokamak.** Gorshkov, A.V.; Potemkin, N.R.; Sannikov, V.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 19p. (In Russian). Order Number DE91600815. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The diagnostics of Thomson scattering with a multipass system of laser radiation input for the measurement of the electron plasma temperature in the peripheral region of the plasma filament at the T-10 device, including the behind-the-limiter region is described. The given diagnostic equipment operates in a wide range of discharge parameter changes (n-bar$_e$(0.5-6)x$10^{13}cm^{-3}$,Te=20-70 eV, I=160-450kA) and permits to measure peripheral electron temperature during single discharge of the tokamak. 6 refs.; 12 figs.; 2 tabs.

50127 (IAE–4785-7) **Methods of superchronous processing of signals in high-temperature plasma diagnostics.** Volkov, V.V.; Kakurin, A.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 21p. (In Russian). Order Number DE91600816. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Applications of methods for synchronous processing of signals in plasma studies have been reviewed. Concrete versions of these methods in the tokamak experiments are presented. 17 refs.; 13 figs.

50128 (IAE–4787-8) **Electron distribution function and rate constants of elementary processes in a tokamak near-wall plasma.** Dvornikova, N.A.; Zajtsev, F.S.; Krasheninnikov, S.I.; Smirnov, A.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 8p. (In Russian). Order Number DE91600844. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The effect of the non-Maxwellian behaviour of the electron distribution function caused by both the collisions of electrons with neutrals and the temperature gradient on the rate constants (RC) of elementary processes in tokamak near-wall plasma has been considered. It is shown that the neutral component causes the change in the RC by less than 10%, the electron temperature gradient at temperatures lower than 4 eV changes the RC several times as compared with the Maxwellian RC. 4 refs.

50129 (IAE–4827-6) **Equilibrium of plasma filament with inhomogeneous field along on axis and without of longitudinal current.** Dobryakov, A.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 17p. (In Russian). Order Number DE91600766. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The equilibrium of a plasma filament with an inhomogeneos nonuniform field along an axis that has not any asymmetry has been considered for the first order of $\beta=8\ \pi p/B^2$ and the curvature. The filament is assumed to be inside an ideally-conducting sheath with a circular cross-section. It is shown that the filament shift depends noticeably on this sheath. The plasma equilibrium has been considered as an example in a Drakon magnetic trap. 9 refs.

50130 (IAE–4838-7) **Diagnostics of impurity and neutral components of tokamak plasma by the resonance fluorescence method.** Talybov, V.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 11p. (In Russian). Order Number DE91600817. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Equipment using resonance fluorescence method for diagnostics of impurity and neutral components of the Tuman-3 tokamak plasma has been developed. The description of the equipment is given. Test results of the equipment are presented. Results of preliminary experiments are given. 8 refs.; 3 figs.

50131 (IAE–4848-16) **Statistical simulation of Coulomb collisions in a plasma.** Semenets, Yu.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 11p. (In Russian). Order Number DE91600845. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A Monte-Carlo method for the Boltzmann equation is used for solving the nonlinear Landau equation for description of processes in collisional fully ionized plasma. 6 refs.; 3 figs.

50132 (IAEA-CN–53/C-4-7) **Fluctuations and stability in the Advanced Toroidal Facility (ATF) torsatron.** Harris, J.H. (Oak Ridge National Lab., TN (USA)); Charlton, L.A.; Bell, J.D.; Bigelow, T.S.; Carreras, B.A.; Colchin, R.J.; Crume, E.C.; Dominguez, N.; Dunlap, J.L.; Dyer, G.R.; England, A.C.; Glowienka, J.C.; Hillis, D.L.; Hiroe, S.; Horton, L.D.; Howe, HInternational Atomic Energy Agency, Vienna (Austria). [1990]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. (CONF-901025–8: 13. international conference on plasma physics and controlled nuclear fusion research, Washington, DC (USA), 1-6 Oct 1990). Order Number DE90017734. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We present the results of experimental and theoretical studies of fluctuations and instabilities in the ATF torsatron, a type of stellarator. Measurements of globally coherent magnetic fluctuations in high-β plasmas with narrow pressure profiles produced by a field error show evidence of self-stabilization ('second stability'); the trends are compatible with theoretical analysis of self-stabilization of resistive curvature-driven instabilities, but there are discrepancies between the absolute experimental and theoretical fluctuation amplitudes. Fluctuation measurements in plasma with broad pressure profiles reveal new phenomena–specifically, toroidally localized magnetic fluctuations, whose amplitudes increase with plasma pressure, and coherent density fluctuations with significant radial width.

50133 (IPPCZ–293/III) **Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak".** Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. 215p. (In Russian, English). (CONF-8903244–: Seminar of CMEA experts on plasma diagnostics in T-15 tokamak, Liblice (Czechoslovakia), 15-16 Mar 1989). Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The proceedings of the seminar contain 19 contributions dealing with various problems of plasma diagnostics in tokamaks and thermonuclear reactors. The diagnostics and data acquisition systems being developed for direct use in the T-15 tokamak are discussed in 15 papers. Particularly, the submillimeter interferometer, X-ray, VUV and neutron spectrometers and the time-of-flight analyzer of neutrals are described in detail. Special attention is paid to nuclear diagnostic methods of fusion products, especially alpha particles. The other papers deal with Langmuir probe measurements in edge plasmas, with the influence of radiation on diagnostic systems and their components and with the general theoretical results on the lower hybrid current drive relevant to hot plasma diagnostics. (J.U.).

50134 (IPPCZ–293/III, pp. 1-11) **Technological start of T-15 tokamak. The start-up diagnostic complex.** Notkin, G.E. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii). Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. (In Russian). (CONF-8903244–: Seminar of CMEA experts on plasma diagnostics in T-15 tokamak, Liblice (Czechoslovakia), 15-16 Mar 1989). In *Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak".* Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The T-15 tokamak with superconducting toroidal winding reached the technological start-up phase. The results of the first operating tests of the main tokamak components are reported. Due to improper function of both the vacuum and the cryogenic system, the nominal parameters of the vacuum and of the toroidal magnetic field have not been achieved. The non-optimum vacuum conditions made the discharge start-up difficult even when a pre-ionizing electron beam and a gyrotron generator were used. The pre-discharge plasma parametes were studied by means of a limited set of plasma diagnostic apparatus. Due to substantially deteriorated vacuum conditions, it was not possible to repeat the only one successful discharge with a current of 100 kA, lasting for 50 ms. (J.U.).

50135 (IPPCZ–293/III, pp. 12-19) **Two-wavelength, multichannel, submillimeter laser interferometer for measurements of plasma density in T-15 tokamak.** Vereszczinski, Z. (Instytut Fizyki Plazmy i Laserowej Mikrosyntezy, Warsaw (Poland)); Kasperczuk, A.; Paduch, M.; Tomaszewski, K.; Lesnewski, M.; Paprocki, K. Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. (In Russian). (CONF-8903244–: Seminar of CMEA experts on plasma diagnostics in T-15 tokamak, Liblice (Czechoslovakia), 15-16 Mar 1989). In *Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak".* Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

A two-wavelength 11-channel submillimeter laser interferometer of the Michelson type is being prepared for electron density measurements in the T-15 tokamak. The optical system of the interferometer and its mechanical supporting structure are described in detail. Attention is paid to the optimization of the laser beam splitting system. Several variants of the laser beam path are discussed and the optimum reflection and transmission coefficients are given, calculated in dependence on the incident beam angle. (J.U.).

50136 (IPPCZ–293/III, pp. 20-29) **Diagnostic system CAE T-15 and prospects of its development.** Gulyaev, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Kovalenko, V.G.; Matalin-Slutskij, L.A.; Slepneva, L.I. Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. (In Russian). (CONF-8903244–: Seminar of CMEA experts on plasma diagnostics in T-15 tokamak, Liblice (Czechoslovakia), 15-16 Mar 1989). In *Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak".* Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The structure of a three-level hierarchical data acquisition and processing system set up for the diagnostic complex of the T-15 tokamak is described, and the prospects of its further development are discussed. The basic principles used in designing the system proved to be correct. Also the software package developed is capable of further improvement, as concerns the number and potential of the diagnostic subsystems and their dynamical characteristics. Nevertheless, some parts of the system are not fully up-to-date and cannot meet all prospective requirements. These parts must be complemented by new subsystems based on progressive technology. (J.U.).

50137 (IPPCZ–293/III, pp. 30-34) **High-resolution spectrometer with a spherical crystal for the T-15 tokamak.** Gryzgunov, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Gil'varg, A.B.; Chuvatin, S.A. Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. (In Russian). (CONF-8903244–: Seminar of CMEA experts on plasma diagnostics in T-15 tokamak, Liblice (Czechoslovakia), 15-16 Mar 1989). In *Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak"*. Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

A high-resolution X-ray spectrometer with a spherical crystal as dispersion element will be used for ion temperature measurements in the T-15 tokamak. A CCD array is supposed to be used to record the outcoming radiation. A spectrometer of the same type but with photographic detection, was tested during experiments in the T-10 tokamak. The ion temperature was evaluated from the Doppler broadening of the resonance lines of He-like chromium ions.

50138 (IPPCZ–293/III, pp. 35-40) **X-ray monochromator for ion temperature measurements in the T-15 tokamak.** Stepanenko, M.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii). Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. (In Russian). (CONF-8903244–: Seminar of CMEA experts on plasma diagnostics in T-15 tokamak, Liblice (Czechoslovakia), 15-16 Mar 1989). In *Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak"*. Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The theory underlying X-ray spectrometers in which a spherically bent crystal is used as the dispersion element, is briefly recapitulated and the basic characteristics of the high-resolution quartz crystal spectrometer developed for ion temperature measurements in the T-15 tokamak are given. The spectral resolution of the spectrometer is 1.7×10^{-4} A/mm. To cover the full range of the ion temperatures expected in the T-15 tokamak, the resonance line of the He-like nickel ion is recommended as the working line. (J.U.).

50139 (IPPCZ–293/III, pp. 41-49) **X-ray spectrometer for the T-15 tokamak.** Sledzinski, S. (Instytut Fizyki Plazmy i Laserowej Mikrosyntezy, Warsaw (Poland)); Nedzelski, V.; Zelinski, B.; Mamczur, M. Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. (In Russian). (CONF-8903244–: Seminar of CMEA experts on plasma diagnostics in T-15 tokamak, Liblice (Czechoslovakia), 15-16 Mar 1989). In *Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak"*. Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

A high-resolution X-ray spectrometer is being developed for plasma diagnostics in the T-15 tokamak. A diagram of the spectrometer is presented. X radiation is analyzed by means of a spherically bent quartz crystal and detected by a scintillator, coupled via fiber optics to an electron-optical image intensifier. The intensified picture is recorded by a TV camera and the output signal is processed by a computer-controlled data acquisition system for which a special software package has been developed. (J.U.).

50140 (IPPCZ–293/III, pp. 50-51) **VUV spectroscopy in the T-15 tokamak.** Bugarya, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Ivanov, I.V.; Krupin, V.A.; Myalton, T.B. Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. (In Russian). (CONF-8903244–: Seminar of CMEA experts on plasma diagnostics in T-15 tokamak, Liblice (Czechoslovakia), 15-16 Mar 1989). In *Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak"*. Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The ion temperature, the impurity level, and the impurity transport in the T-15 tokamak will be studied by methods of VUV plasma diagnostics. The VUV diagnostic complex will consist of several VUV spectrometers covering the range of 10 to 2000 A. The basic characteristics of the spectrometers are given. (J.U.).

50141 (IPPCZ–293/III, pp. 52-53) **Charge-exchange spectroscopy in the T-15 tokamak.** Berezovskij, E.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Krupin, V.A. Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. (In Russian). (CONF-8903244–: Seminar of CMEA experts on plasma diagnostics in T-15 tokamak, Liblice (Czechoslovakia), 15-16 Mar 1989). In *Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak"*. Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The ion plasma temperature in the T-15 tokamak will be evaluated from the Doppler broadening of resonance lines excited by the charge exchange of plasma ions on atoms of the diagnostic and heating neutral beams. The diagnostic complex will consist of several spectral analyzers working both in the visible and VUV spectral regions. (J.U.).

50142 (IPPCZ–293/III, pp. 54-63) **Automated system of visible and ultraviolet spectroscopy for the T-15 tokamak.** Borowecki, M. (Instytut Fizyki Plazmy i Laserowej Mikrosyntezy, Warsaw (Poland)); Mamczur, M.; Nedzelski, V.; Skrzeczanowski, V.; Zelinski, B. Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. (In Russian). (CONF-8903244–: Seminar of CMEA experts on plasma diagnostics in T-15 tokamak, Liblice (Czechoslovakia), 15-16 Mar 1989). In *Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak"*. Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

Visible and VUV radiation spectroscopy represents one of the most important techniques of plasma diagnostics in the T-15 tokamak. A diagram of the spectroscopic apparatus developed in IPPLM, Warsaw is given, the optical system and its mechanical structure are described in detail, and the results of the detector testing are reported. The computer control system and the software used are also dealt with.

50143 (IPPCZ–293/III, pp. 64-73) **A time-of-flight analyzer of low energy atoms (preliminary test on the CASTOR tokamak).** Stoeckel, J. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu); Vetesnik, P.; Jakubka, K.; Zacek, F.; Berezovskij, E.L. Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. (CONF-8903244–: Seminar of CMEA experts on plasma diagnostics in T-15 tokamak, Liblice (Czechoslovakia), 15-16 Mar 1989). In *Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak"*. Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The time-of-flight analyzer TOFAN is described, developed for determination of the central ion temperature in the CASTOR tokamak for energy-resolved monitoring of particle fluxes from the plasma edge in the T-15 tokamak. The analyzer makes it possible to detect charge exchange atoms in the energy range of 0.02 to 1 keV. The neutral atom flux is chopped by a rotating chopper disc and detected by a secondary emission detector, followed by an electron multiplier and a wide-band preamplifier. Preliminary results of absolute calibration of the apparatus are reported and the first energy spectra of neutrals from the CASTOR tokamak plasma are shown. (J.U.).

50144 (IPPCZ–293/III, pp. 85-107) **Project of CFP plasma diagnostic system for the T-15 tokamak.** Zaveryaev, V.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Popovychev, S.V.; Zhogolev, V.E.; Putvinskij, S.V.; Majsyukov, V.D.; Gamayunov, S.N.; Mirskij, I.E.; Shevchenko, A.P. Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. (In Russian). (CONF-8903244–: Seminar of CMEA experts on plasma diagnostics in T-15 tokamak, Liblice (Czechoslovakia), 15-16 Mar 1989). In *Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak"*. Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

Various charged particles originating in fusion reactions, such as protons, tritons, ^{3}He nuclei and alpha particles, provide valuable information on thermonuclear plasma parameters. Plasma diagnostic methods based on the detection of charged fusion products will be used in the T-15 tokamak. A diagram of the diagnostic system is

shown and its individual parts are described in detail. The charged particles will be detected by room-temperature surface-barrier detectors, shielded against UV and visible radiation and equipped with microchannel plates serving as collimators. Theoretical estimates of the number of recorded particles and results of preliminary calibration measurements of the detectors are presented. (J.U.).

50145 (IPPCZ–293/III, pp. 138-169) **Some problems of plasma diagnostics in an experimental thermonuclear reactor.** Orlinskij, D.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii). Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. (In Russian). (CONF-8903244–: Seminar of CMEA experts on plasma diagnostics in T-15 tokamak, Liblice (Czechoslovakia), 15-16 Mar 1989). In *Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak".* Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

General problems of the choice of plasma diagnostic methods for experimental thermonuclear reactors are discussed. The parameters of the designed reactors and the radiation conditions in their environment are briefly reviewed, and the influence of radiation on various diagnostic systems is examined. The diagnostic systems suitable for the technological and physical stages of the reactor operation are discussed. At the physical stage, the investigation of plasma heating by alpha particles and of their influence on the plasma confinement is of primary importance. Attention is paid to various methods of diagnostics of both the confined and the escaping alpha particles, each method being discussed in detail. (J.U.).

50146 (IPPCZ–293/III, pp. 170-194) **Diagnostics of a thermonuclear plasma, based on the use of nuclear reactions.** Kiptilyj, V.G. (AN SSSR, Leningrad (USSR). Fiziko-Tekhnicheskij Inst.). Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. (In Russian). (CONF-8903244–: Seminar of CMEA experts on plasma diagnostics in T-15 tokamak, Liblice (Czechoslovakia), 15-16 Mar 1989). In *Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak".* Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

Intense thermonuclear processes in future thermonuclear devices will make it possible to use fusion products for the determination of thermonuclear plasma parameters. Nuclear reactions between various plasma particles such as protons, deuterons, tritons, alpha particles and light target nuclei, are discussed from the point of view of hot plasma diagnostics. Especially the resonant radiative capture reactions are recommended for investigation of the interaction of fast alpha particles and protons with a plasma. The ion plasma temperature may be determined also from neutron-induced target activation. All the diagnostic methods mentioned are based on the spectroscopy of gamma radiation. The advantages of the gamma spectroscopic methods in comparison with conventional methods are emphasized. (J.U.).

50147 (IPPCZ–293/III, pp. 120-137) **Results of preliminary theoretical investigations of the lower hybrid current drive in the T-15 tokamak.** Klima, R. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu); Pavlo, P.; Petrzilka, V.A.; Preinhaelter, J.; Hurtak, O.; Parail, V.V. Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. (In Russian). (CONF-8903244–: Seminar of CMEA experts on plasma diagnostics in T-15 tokamak, Liblice (Czechoslovakia), 15-16 Mar 1989). In *Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak".* Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The results of a theoretical study of the lower hybrid current drive in tokamaks are used to choose the optimum frequency of the feeding high-frequency generator. It is shown that the frequency of 3.6 GHz applied, e.g., in the JET facility is not suitable for the T-15 tokamak. After a brief recapitulation of the multijunction grill theory, the problems of grill optimization are discussed. The optimum grill spectrum is found, and its modification due to wave scattering on plasma density fluctuations is studied. The peripheral plasma density for the lower hybrid current drive is shown to be the most important parameter for the choice of the generator frequency. For the T-15 tokamak, a frequency of 4.6 GHz is recommended. (J.U.).

50148 (IPPCZ–293/III, pp. 204-211) **Investigation of edge plasma by means of Langmuir probes.** Rainer, H.-D. (Akademie der Wissenschaften der DDR, Berlin (German Democratic Republic). Zentralinstitut fuer Elektronenphysik); Herrmann, A.; Laux, M.; Pech, P.; Sachtleben, J. Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. (In Russian). (CONF-8903244–: Seminar of CMEA experts on plasma diagnostics in T-15 tokamak, Liblice (Czechoslovakia), 15-16 Mar 1989). In *Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak".* Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

Two instruments were developed for exploitation of Langmuir probes in the T-15 tokamak. The Langmuir-2 system is designed for measurements with single and double Langmuir probes, including computerized acquisition and processing of experimental data. A more sophisticated version of the previous system, Langmuir-3, enables parallel measurements with up to 8 Langmuir probes of any type at enhanced accuracy and dynamic range. Problems of interpretation of Langmuir probe data obtained in plasmas with strong magnetic fields also are discussed. (J.U.).

50149 (IPPCZ–293/III, pp. 212-215) **A method for determination of the electron temperature from Langmuir probe data in a tokamak edge plasma.** Dvoracek, J. (Karlova Univ., Prague (Czechoslovakia). Fakulta Matematicko-Fyzikalni); Sicha, M.; Tichy, M.; Vesely, V.; Kryska, L.; Stoeckel, J.; Zacek, F. Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu. May 1989. (CONF-8903244–: Seminar of CMEA experts on plasma diagnostics in T-15 tokamak, Liblice (Czechoslovakia), 15-16 Mar 1989). In *Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak".* Order Number DE91600824. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The effect of the ion current on the accuracy of the electron temperature determination by Langmuir probe measurements in tokamaks is investigated. The results of edge plasma studies performed in the CASTOR tokamak show that an ion correction must be included in the Langmuir probe data analysis. To minimize the influence of the ion current, the well known method of transformation of the single probe characteristics to the double probe one appears to be convenient. (J.U.).

50150 (ITEF–78-89) **Maximum compression of Z-pinch in a gas with high atomic number.** Gerusov, A.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1989. 36p. (In Russian). Order Number DE91600803. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

An ideal system of equations with shock heating is used for describing of a Z pinch in a gas with high atomic number. In this case equations do not depend from the installation parameters. The approximate simple solution of such a system is presented. Numerical calculations of equations with radiative cooling and various dissipative effects have determined the employment conditions of ideal magnetohydrodynamic equation system. 10 refs.

50151 (ITF–88-110) **The spectra of spontaneous emission from inhomogeneous plasma half-space.** Gvozdetskij, V.S.; Zagorodnij, A.G.; Krivtsun, I.V.; Korchinskij, G.M.; Yakimenko, I.P. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1988. 36p. (In Russian). Order Number DE91600864. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The fluctuation theory of spontaneous emission from plasma half-space with the arbitrary profile of transition layer is developed. 18 refs.; 15 figs.

50152 (ITF–88-146) **Parametric instabilities of electromagnetic waves in layer of plasma-molecular medium.** Golubinskij, P.K.; Zagorodnij, A.G.; Yakimenko, I.P. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1988. 24p. (In Russian). Order Number DE91600865. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The kinetic theory of the stimulated scattering of electromagnetic waves is developed for a layer of plasma-molecular medium. The

dispersion relations describing the parametric excitations of volume and surface waves by a weak high-frequency field are obtained. 14 refs.

50153 (ITF–88-157) **Electromagnetic wave incoherent reflection by a plasma layer.** Zagorodnij, A.G.; Usenko, A.S. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1989. 47p. (In Russian). Order Number DE91600866. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The differential coefficients of incoherent electromagnetic waves reflected and transmitted by a weakly ionized plasma layer are calculated for arbitrary values of the coefficients of the particle absorption by the boundaries. The effect produced by the electron interaction with the boundaries on the frequency and angular distributions of the scattering emission is studied in detail. 23 refs.; 8 figs.

50154 (ITF–89-2) **Equilibrium distributions in plasma-molecular systems with non-plane boundaries.** Usenko, A.S. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1989. 19p. (In Russian). Order Number DE91600804. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Equilibrium space-inhomogeneous distributions of free and pair-bound particles are calculated for a plasma-molecular cylinder and sphere. The influence of the parameters of outer medium and a plasma-molecular system on the space and orientational distributions of charged particles and molecules is studied in detail. 34 refs.

50155 (JAERI-M–90-066) **Review of JT-60 experimental results from January to October, 1989.** Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 314p. Order Number DE90520221. Source: NTIS (US Sales Only), PC A14/MF A01.

Emphases in recent JT-60 experiments are placed on (1) improvements in plasma confinement with profile control and (2) steady state operation study. Both limiter and lower X-point divertor configurations were employed. The operating gas was hydrogen and, in some cases, helium. Improvements in confinement were demonstrated with pellet injection, LH current drive, high-Ti mode operation or ICRF. Current profile controllability with energetic electrons has been improved by the new LH launcher. The H-mode was achieved in limiter discharges with LH current drive for the first time. Nearly steady-state ELM-free H-mode with durations up to 3.3. sec was established without significant impurity accumulation. High-Ti and high-βp discharges were obtained in high field and low plasma current. Major experimental issues for the steady-state operation research were non-inductive current drive and He-ash exhaust. The neoclassical bootstrap current was confirmed in the wide range of βp. 30 keV helium NB was injected into NB heated lower X-point discharges, which produced centrally peaked birth profile of α-particles. A simple extension of the present result is promising for the helium exhaust in future device. (J.P.N.).

50156 (JAERI-M–90-081) **Density limit in JT-60.** Kamada, Yutaka (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Hosogane, Nobuyuki; Hirayama, Toshio; Tsunematsu, Toshihide. Japan Atomic Energy Research Inst., Tokyo (Japan). May 1990. 21p. Order Number DE90520263. Source: NTIS (US Sales Only), PC A03/MF A01.

This report studies mainly the density limit for a series of gas- and pellet-fuelled limiter discharges in JT-60. With the pellet injection into high-current/low-q (q(a)=2.3≈2.5) discharges, the Murakami factor reaches up to 10≈13 x 10^{19} $m^{-2}T^{-1}$. The values are about factors of 1.5≈2.0 higher than those for usual gas-fuelled discharges. The pellet injected discharges have high central density, whereas the electron density in the outer region (a/2<r) is limited below the same level with that for gas fuelled plasmas. The density limit can be explained with the power balance in the outer region of the plasma, for which the plasma purity (Zeff), heating power and the electron temperature are the key parameters. The disruptive limit of the density can be explained by P_{abs} and n_e^2(r=50 cm) x Z_{eff} (r=50 cm). (author).

50157 (KFTI–88-21) **Forced scattering of a non-ordinary electromagnetic wave by an electron beam in a plasma in magnetic field.** Miroshnichenko, V.I.; Fajnberg, Ya.B. AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst. 1988. 19p. (In Russian). Order Number DE91600867. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A theory of collective processes under forced coherent scattering of a non-ordinary electromagnetic wave propagating in a plasma placed in a constant magnetic field is developed. A system of nonlinear reduced equations describing amplitude variation of interacting wave fields and the beam electron motion that in a general case is supposed to be relativistic is obtained. Cases of following and counter-running non-ordinary waves scattering by an electron beam are considered separately, elementary mechanisms forming the basis of such interaction are detected. In case of the fillowing non-ordinary wave scattering by an electron beam such elementary mechanism is anomalous scattering and case of counter-ordinary wave scattering - normal scattering. Scattered wave amplitude gain factors in limiting cases of realization of Raman scattering and modified decay are determined. Plasma role and effect on scattering are ascertained. 13 refs.

50158 (KFTI–88-26) **Study on the atom beams and plasma production at the materials evaporation by laser radiation.** Volkov, Ya.F.; Dyatlov, V.G.; Kiyashko, V.A.; Kornilov, E.A.; Mitina, N.I. AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst. 1988. 11p. (In Russian). Order Number DE91600805. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Possibility of plasma production from vapors of lead target irradiated by laser impulse with the following ionization of vapors by quick-changing magnetic field is considered. It is shown that when using neodium laser with the energy of up to 23 J the pulse duration of 0.8 μs and laser radiation intensity on target surface of 5-6 J/cm^2, the total number of evaporated lead atoms attains $\simeq 10^{19}$ per impulse. Under the effect of quick-changing acute-angle geometry magnetic field with H_{max} = 9 kOe, period of 40 μs plasma consisting mainly of Pb^{+3} and Pt^{+4} ions and with the density up to $n_e \simeq 1.5x10^{-3}$ is produced. Therewith due to plasma accumulation in a magnetic trap its maximum density is by an order of magnetude greater the initial vapor density. 9 refs.; 6 figs.; 1 tab.

50159 (KFTI–88-35) **Excitation of regular oscillations and acceleration of charged particles by electron beam in a non-uniform plasma resonator.** Balakirev, V.A.; Ostrovskij, A.O.; Tkach, Yu.V. AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst. 1988. 8p. (In Russian). Order Number DE91600868. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Theoretical study of the non-uniform plasma density effect on dynamics of excitation of regular oscillations and acceleration of charged particles by electron beam in plasma resonator is carried out. It is shown that the main effect caused by non-uniformity of plasma density in a short magnetized plasma resonator ($\varkappa$L <or approx. 1, L -resonator length, $\varkappa$ - direct plasma wave gain factor) is origination of self-modulation modes of oscillations excitation and increase of the beam starting currents. Therewith possibility of effective realization of the two-beam electron acceleration mechanism is preserved. 7 refs.

50160 (KFTI–88-46) **Installation of disruption instability in the Uragan-2 large-shear stellarator.** Arsen'ev, A.V.; Volkov, E.D.; Kovalev, S.V.; Konovalov, V.G.; Kulaga, A.E.; Perepelkin, N.F.; Shapoval, A.N. AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst. 1988. 14p. (In Russian). Order Number DE91600856. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Instability of a single (small) disruption under weak electric fields E < E_{cr} and small currents [l/H] = 0.37 with strong plasma magnetization $\omega_{ce} > \omega_{pe}$ is studied in Uragan-2 racetrack stellarator in quasistationary ohmic discharges. Instability was observed at the stage of slow current decay under rather low MHD-activity of plasma. Disruption was accompained by typical perturbations of current magnetic field (m = 1, n = 0) corresponding to reconstruction of stellarator magnetic configuration and relaxation of all plasma parameters as well as plasma heating and decrease of the filament inductance. Disruption is not due to relaxation of fan-type

instability. Possibility of reinitiation of small disruption plasma current being maintained near the threshold value is shown. It is most probable that disruption instability mechanism is due to loss of filament equilibrium rested on resonance surface $t_\xi = 1.0$ or is due to loss of local equilibrium near this surface facing the plasma filament boundary. Further evolution of perturbation has many common features with the model of internal disruption instability in a tokamak suggested by Kadomtsev. 13 refs.; 7 figs.

50161 (NIFS–11) **Effect of confinement of SoL plasma on core temperature profile.** Itoh, K.; Itoh, S.-I. National Inst. for Fusion Science, Nagoya (Japan). Feb 1990. 11p. Order Number DE90520198. Source: NTIS (US Sales Only), PC A03/MF A01.

The dependence of the core confinement on the edge plasma parameter is discussed in L-mode tokamaks. Employing the result of the transport analysis in the scrape-off layer, the boundary condition for the transport in the core plasma is expressed in terms of the heating power. Various forms of the dependences of local thermal conductivity on the temperature and temperature gradient are examined. The power dependence of the edge temperature is found to be an origin of the profile resiliency holds in a wide range of the heating power in L-mode tokamaks. (author).

50162 (NIFS–12) **Plasma diagnostics and atomic processes.** Kato, Takako. National Inst. for Fusion Science, Nagoya (Japan). Feb 1990. 38p. Order Number DE90520197. Source: NTIS (US Sales Only), PC A03/MF A01.

Spectroscopic plasma diagnostics with the use of atomic processes are discussed relating to three subjects in the followings. (i) Time resolved X-ray spectra of titanium helium-like ions from tokamaks. X-ray spectra observed from tokamak plasmas are analysed with a non-ionization equilibrium model which could explain the time behavior of both spectra and ion abundances. (ii) Line intensity ratios of OV ions for temperature and density diagnostics. Intensity ratios of emission lines from OV ions are calculated for use in temperature and density diagnostics. The line emissions from a tokamak are analysed for the diagnostics of plasma periphery. (iii) Collisional processes in hot dense plasmas. The collisional ladder-like excitation and ionization in a hot dense plasma are discussed for the dielectronic states. This process enhances the excitation rate coefficients and decreases the resonance contributions to the excitation cross section. (author).

50163 (NIFS–14) **Current bubble formation by nonlinear coupling of resistive tearing modes.** Urata, Kazuhiro; Hatori, Tadatsugu; Amano, Tsuneo. National Inst. for Fusion Science, Nagoya (Japan). Feb 1990. 15p. Order Number DE90520195. Source: NTIS (US Sales Only), PC A03/MF A01.

The current bubble means a helical duct with low current density invading the inner high current region of current carrying toroidal plasmas. It is a non-turbulent analogue of the MHD clump. The numerical simulations show that it appears right after the absorption of a small magnetic island into the chaotic layer in the separatrix region of a large magnetic island. (author).

50164 (NIFS–15) **An empirical scaling of the thermal diffusivity applicable to both L- and H-mode discharges.** Ohyabu, N. National Inst. for Fusion Science, Nagoya (Japan). Feb 1990. 15p. Order Number DE90520194. Source: NTIS (US Sales Only), PC A03/MF A01.

An empirical scaling of the thermal diffusivity has been constructed which fits well with most of the key observations of steady-state heat transport in tokamaks. This scaling also agrees with observed dynamical transport phenomena and suggests interesting future experiments. (author).

50165 (PSC–7) **Conditions for ion reflection in a large-amplitude magnetosonic wave.** Ohsawa, Y. Nagoya Univ. (Japan). Plasma Science Center. Apr 1990. 26p. Order Number DE90520329. Source: NTIS (US Sales Only), PC A03/MF A01.

Ion orbits in a large-amplitude magnetosonic wave are studied numerically and analytically. The orbits are classified into three basic types. In the first type, ion pass through the wave without reflection and do not gain much energy. In the second type, they are reflected once and are accelerated in the direction of the wave normal; after the reflection they return to the wave front by the Lorentz force and pass through the wave. In the third type, they are reflected several times and are accelerated along the wave front; when they reach their maximum speeds, they are detrapped. Conditions for these types of reflection are discussed and the energies of accelerated ions are evaluated. (author).

7002 Fusion Power Plant Technology

Refer also to citation(s) 48403, 48601, 48859, 48998, 49366, 49986, 50056, 50111, 50117, 50144, 50155, 50156, 50219

50166 (CEA-CONF–9890) **Evidence of Rayleigh-Taylor instabilities in tri-layer targets.** Galmiche, D.; Holstein, P.A.; Meyer, B.; Rostaing, M.; Wilke, N. CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France). 1988. 5p. (CONF-8810234–: Workshop on the physics of compressible turbulent mixing, Princeton, NJ (USA), 24-27 Oct 1988). Order Number DE91700540. Source: NTIS (US Sales Only), PC A02/MF A01.

The results of the experiments carried out on a laser system are reported. The work is performed in order to investigate the problem of target instability under ablative acceleration and to get direct evidence of Rayleigh-Taylor instabilities. Tri-layer experiments assert the validity of X-ray spectroscopy measurements as experimental method to investigate the problem. A mixing zone is evidenced and general trends of mixing development versus target acceleration are coherent with numerical simulations. Results obtained with optical smoothing demonstrate that the apparent mixing is not due to large scale illumination non uniformities. Numerical simulations confirm that Rayleigh-Taylor instability seems to be the dominant process responsible for the mixing. Benefit of time resolved spectroscopy appears attractive and gives a real knowledge of the mixing layer.

50167 (CONF-900623–19) **Relationship of microstructure and tensile properties for neutron-irradiated vanadium alloys.** Loomis, B.A.; Smith, D.L. Argonne National Lab., IL (USA). [1990]. 28p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 15. symposium on effects of radiation on materials; Nashville, TN (USA); 17-21 Jun 1990. Order Number DE90017863. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The microstructures in V-15Cr-5Ti, V-10Cr-5RTi, V-3Ti-1Si, V-15Ti-7.5Cr, and V-20Ti alloys were examined by transmission electron microscopy after neutron irradiation at 600°C to 21–84 atom displacements per atom in the Materials Open Test Assembly of the Fast Flux Test Facility. The microstructures in these irradiated alloys were analyzed to determine the radiation-produced dislocation density, precipitate number density and size, and void number density and size. The results of these analyses were used to compute increases in yield stress and swelling of the irradiated alloys. The computed increase in yield stress was compared with the increase in yield stress determined from tensile tests on these irradiated alloys. This comparison made it possible to evaluate the influence of alloy composition on the evolution of radiation-damaged microstructures and the resulting tensile properties. 11 refs.

50168 (CONF-901007–2) **Updated comparison of economics of fusion reactors with advanced fission reactors.** Delene, J.G. Oak Ridge National Lab., TN (USA). [1990]. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 9. topical meeting on technology of fusion energy; Oak Brook, IL (USA); 7-11 Oct 1990. Order Number DE90017740. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The projected cost of electricity (COE) for fusion is compared with that from current and advanced nuclear fission and coal-fired plants. Fusion cost models were adjusted for consistency with advanced fission plants and the calculational methodology and cost factors follow guidelines recommended for cost comparisons of advanced fission reactors. The results show COEs of about 59–74 mills/kWh for the fusion designs considered. In comparison, COEs for future fission reactors are estimated to be in the 43–54 mills/kWh range with coal-fired plant COEs of about 53–69 mills/kWh ($2–3/GJ coal). The principal cost driver for the fusion plants relative to fission plants is the fusion island cost. Although the estimated COEs for fusion are greater than those for fission or coal,

the costs are not so high as to preclude fusion's competitiveness as a safe and environmentally sound alternative.

50169 (DOE/DP/10560–7) **KMS Fusion Inc., 1989 semi-annual technical report, October 1988–March 1989.** McGrath, J.F. (ed.). KMS Fusion, Inc., Ann Arbor, MI (USA). Apr 1989. 123p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC03-87DP10560. (KMSF-U–2205). Order Number DE90017515. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This report discusses the following topics: cryogenic technology; empirical correlation of polystyrene shell properties with processing parameters; glass shell fabrication and characterization; coating technology; development of characterization techniques; induced spatial incoherence capabilities; laser-plasma interaction experiments; theory of laser-plasma interactions; and computational physics.

50170 (EUR–12522, pp. 133-157) **Irradiation testing for fusion technology. Current programme and future plans of KfK.** Roehrig, H.D. (Kernforschungszentrum Karlsruhe G.m.b.H. (DE)). Commission of the European Communities, Luxembourg (Luxembourg). 1989. (CONF-8904378–: HFR Colloquium, PETTEN (Netherlands), 20-21 Apr 1989). In *Prospects and future utilization.* Order Number DE91702056. Source: NTIS (US Sales Only), PC A18/MF A01.

Nuclear fusion, like any other nuclear technology, involves radiation, and the problems encountered from this fact are in principle similar as for fission reactors. The design of a fusion system can therefore, to a certain extent, start from existing materials and existing data on materials behaviour under fission reactor irradiation. But there are limits both of a fundamental and a practical nature. The practical restriction is simply that for certain materials irradiation data are limited or non-existent, that the dose-level has to be extended, that the irradiation temperatures and neutron spectra are different etc. The fundamental restriction is much more severe. It is caused by the fact that the favoured fusion reaction $D + T \rightarrow n + \alpha$ yields neutrons of about 14 MeV energy which in turn do not only cause damage by knock-on processes but also produce light reaction products like helium and protons which many cause strength degradation. To account for these effects several approaches are being made or planned world-wide. As an example, materials can be enriched with boron or nickel to produce sufficent helium in thermal reactors. Or, helium can be implanted in samples by accelerator irradiation, and these samples can afterwards (or at the same time) be irradiated in reactors or in a second particle beam. None of these methods is fully satisfying, be it for physical, technological or economic reasons. But it can be stated that they are all needed to contribute to an understanding of the irradiation effects to be expected in a fusion reactor. The role of the materials test reactors is clearly to provide irradiation data for a selection of materials by sufficient numbers and sizes of samples over the full range of possible operation parameters, e.g. temperatures, environment, flux and dose levels.

50171 (EUR–12522, pp. 159-177) **KFA Neutron irradiation programme on materials for high heat load components of fusion devices.** Thiele, B.A. (Kernforschungsanlage Juelich G.m.b.H. (DE). Inst. fuer Reaktorwerkstoffe). Commission of the European Communities, Luxembourg (Luxembourg). 1989. (CONF-8904378–: HFR Colloquium, PETTEN (Netherlands), 20-21 Apr 1989). In *Prospects and future utilization.* Order Number DE91702056. Source: NTIS (US Sales Only), PC A18/MF A01.

In this paper, after a brief description of the NET diverter, the author presents the experimental irradiation programme made on graphites and carbon-carbon fiber composites.

50172 (EUR–12522, pp. 179-196) **The function of the HFR, Petten, in the development of plasma facing components for fusion reactors.** Van der Schaaf, B. (Netherlands Energy Research Foundation, PETTEN (NL). Energy Study Centre). Commission of the European Communities, Luxembourg (Luxembourg). 1989. (CONF-8904378–: HFR Colloquium, PETTEN (Netherlands), 20-21 Apr 1989). In *Prospects and future utilization.* Order Number DE91702056. Source: NTIS (US Sales Only), PC A18/MF A01.

Plasma facing components comprise a wide range of materials from austenitic steel for the vacuum wall to carbon materials and ceramics in protection structures. Their application has one main environmental aspect in common: radiation damage from high energy neutrons. In the European Fusion Technology Programme the post-irradiation mechanical properties of austenitic stainless and ferritic martensitic steels, including advanced welded joints, are studied. The development of reduced activation alloys on both iron and vanadium bases are also relying of the HFR capabilities, as will be shown. The importance of the HFR for the improvement of wall protection with ceramics and carbon materials will be indicated. The HFR, Petten, produces high energy fission neutrons, but it constitutes a most useful tool to investigate fusion radiation effects in materials.

50173 (EUR–12522, pp. 197-224) **Joint research centre fusion materials irradiations in HFR: Present status and prospectives.** Casini, G. (Commission of the European Communities Ispra (IT). Joint Research Centre); Fenici, P. Commission of the European Communities, Luxembourg (Luxembourg). 1989. (CONF-8904378–: HFR Colloquium, PETTEN (Netherlands), 20-21 Apr 1989). In *Prospects and future utilization.* Order Number DE91702056. Source: NTIS (US Sales Only), PC A18/MF A01.

First a review is made of the Joint Research Centre experimental activity at HFR-Petten in the frame of the Fusion Technology and Safety Programme. The materials under investigation are: Cr-Ni Austenitic steels (316-L type) and Cr-Mn Austenitic steels (AMCR and FI type) as structural materials and Pb-17Li eutetic as tritium breeding material. The experiments on structural materials comprise: Sample irradiations with post-irradiation tensile tests (FRUST) Sample irradiations under constant load and post-irradiation strain measurement (TRIESTE) On-line creep tests (CRISP). The experiments on Pb-17Li breeder material regard sample irradiations to investigate tritium production and recovery as well as tritium permeation through blanket structures (LI-BRETTO Experiment). Both irradiations on structural and breeding materials will be pursued up to the end of the current JRC-Multiannual Programme (1988-1991) and even further. In the last part of the paper expected developments of the testing programme at HFR are discussed. New areas of research should involve materials for divertor applications (NET/ITER) and advanced low activation composite materials for Commercial Power Reactors.

50174 (IAE–4702-16) **Technique for calculation of electrostatic fields of high-current accelerator elements.** Pichugin, V.E. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1988. 29p. (In Russian). Order Number DE91600903. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Numeric algorithms for solving electrostatics problems are described. Fields in double forming lines of Angara-5 device modulus and in high-current accelerator acclerating tubes are calculated. Finite difference method realized in the ERA applied program package serves as the basis. Here the PG-2M inlet complex, comprising a specially developed PG-2M language, PG-2M translator and an internal language is used for the first time which allows one to easily and rapidly prepose information about calculated area geometry, boundary conditions and electrostatic field characteristics derived. 15 refs.; 10 figs.

50175 (IAE–4792-8) **Study on centrifugal acceleration of hydrogen pellets.** Zayatdinov, R.M.; Kareev, Yu.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 21p. (In Russian). Order Number DE91600901. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The numerical research results of solid hydrogen pellets acceleration for introducing them in thermonuclear parameter plasma by centrifuge are presented. A few forms of rotor track channels are considered and their comparative analysis is carried out. Two regions of rotor angle speed meannings are distinguished. In a first region the pellet speed is limited by rotor material hardness, in a second region - by pellet hardness itself. The first region is preferred since the pellet speed may achieve 2-2.4 km/s using organoplastic or carbonic fibre as the rotor material. 9 refs.; 13 figs.

50176 (IAE–4853-16) **Quasiequilibrium evolution of compact torus with toroidal field.** Belikov, V.V. (and others); Belikova,

G.V.; Goloviznin, V.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1989. 17p. (In Russian). Order Number DE91600899. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The numerical calculations of adiabatic evolution of equilibrium magnetic configurations of a compact torus (CT) in the toroidal magnetic fields are present. These studies are performed in two regions: (1)CT formation takes place in the coaxial cavity, the coaxial component H_r being excited by the current from axial electrode; (2)The formation takes place in a hollow cylindrical chamber with two edge electrodes, and H_ϕ field is excited by current in plasma. 13 refs., 7 figs.

50177 (ITEF–87-89) **GITTAM code for numerical simulation of one-dimensional targets for heavy ion fusion. Part 1: Pt.1 System of equations.** Basko, M.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1989. 20p. (In Russian). Order Number DE91600904. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Equations are presented which enable one to perform numerical simulations of one-dimensional thermonuclear targets driven by fast ion beams. Radiation transport is approximated by the diffusion equation for radiative temperature. Nonlocal deposition of the thermonuclear energy is treated in the framework of simple approximations. 6 refs.

50178 (ITEF–89-89) **GITTAM program for numerical simulation of one-dimensional targets TIS. Part 3: 3. Testing calculations.** Basko, M.M.; Sokolovskij, M.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1989. 28p. (In Russian). Order Number DE91600905. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Results of testing calculations according to GITTAM program, developed for numeric simulation of one-dimensional thermonuclear targets of heavy-ion synthesis are presented. Finite-difference method for solving a system of one-dimensional hydrodynamics equations with heat conductivity, radiation diffusion and thermonuclear combustion is used in the GITTAM program. In the tests presented, based on simple automodel solutions, adiabatic motion as well as distribution of shock, thermal and radial waves in gas with simple polytron state equation is investigated. 3 refs.; 6 figs.

50179 (KFTI–88-34) **Analytical representation of the geometry of helical windings for plasma devices.** Vorob'eva, V.P.; Georgievskij, A.V.; Lyubarskij, G.Ya.; Martynov, S.A.; Khazhmuradov, M.A. AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst. 1988. 9p. (In Russian). Order Number DE91600900. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Algorithm of analytical description of the geometry of helical windings (HW) of high-torsion torsatrons is suggested. This permitted to automize the HW construction to reduce their design time and to increase labour productivity of designers searching optimal variant of a new device. 5 refs.; 6 figs.

50180 (NIFS–10) **Adiabatic invariant and evaluation of particle loss in helical torus.** Todoroki, Jiro. National Inst. for Fusion Science, Nagoya (Japan). Feb 1990. 41p. Order Number DE90520199. Source: NTIS (US Sales Only), PC A03/MF A01.

Analytic expression for the longitudinal adiabatic invariant is derived for general magnetic configuration. The orbit loss is evaluated to determine the outermost loss-free surface. Geometrical factor of the neoclassical transport coefficients in $1/\nu$ regime in helical torus is calculated by using the longitudinal adiabatic invariant. The dependence of the particle confinement upon the geometrical parameter is investigated for N = 10 configurations; and the improvement by the inward shift of the magnetic axis is quantitatively clarified. (author).

50181 (NIFS–13) **Loss cone region in toroidal helical systems.** Itoh, K.; Sanuki, H.; Todoroki, J.; Kamimura, T.; Itoh, S.-I.; Fukuyama, A.; Hanatani, K. National Inst. for Fusion Science, Nagoya (Japan). Feb 1990. 36p. Order Number DE90520196. Source: NTIS (US Sales Only), PC A03/MF A01.

Analytic formula is derived for the loss cone in the toroidal helical systems. Particular emphasis is put on the loss region for the particles which are barely trapped in the helical ripples. Effects of the radial electric field and shifts of the magnetic axis are discussed. Loss region is shown to be much wider than the evaluation given for the deeply trapped particles. (author).

50182 (RAL–90-022) **Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.** Davies, J.D. (Birmingham Univ. (UK). School of Physics and Space Research). Rutherford Appleton Lab., Chilton (UK). May 1990. 117p. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). Order Number DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

In this booklet of conference proceedings, there are sections dedicated to experimental and theoretical work on muon catalyzed fusion. The final section deals with cold fusion. The booklet commences with a description of how muon catalyzed fusion came about and the basic theory behind it. (U.K.).

50183 (RAL–90-022, pp. 10-12) **Experimental investigation of muon-catalysed fusion in pure deuterium: current status and future possibilities.** Zmeskal, J. (Austrian Academy of Sciences, Vienna (Austria). Inst. for Medium Energy Physics); Kammel, P.; Scrinzi, A. Rutherford Appleton Lab., Chilton (UK). May 1990. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). In *Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.* Order Number DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

This paper charts the experimental status of muon catalyzed fusion from 1960 to the present, noting a dramatic rise in interest from 1984 onwards. Theoretical work focused on resonance energies calculations and accurate work on the formation of matrix elements. The temperature dependence of formation rates for fusion products is noted. Work on very high temperature regions and the measurement of hyperfine transitions is planned for future research. (U.K.).

50184 (RAL–90-022, pp. 13-22) **Review of μCF and new LAMPF results.** Jones, S.E. (Brigham Young Univ., Provo, UT (USA). Dept. of Physics and Astronomy); Anderson, A.N. Rutherford Appleton Lab., Chilton (UK). May 1990. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). In *Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.* Order Number DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

This paper on muon-catalyzed fusion reviews the study of yield, or the number of fusions per muon as a sum of the probabilities of muon decay during the catalysis cycle and of muon-scavenging in the dead-end processes. Current fusion yields are examined by considering energy applications for muon-catalyzed fusion. Power generation by this process seems unlikely at present because of the barrier imposed by the alpha-muon sticking and currently available production rates for muons. (U.K.).

50185 (RAL–90-022, pp. 23-26) **Interpretation of recent LAMPF results on dtμ formation.** Leon, M. (Los Alamos National Lab., NM (USA)). Rutherford Appleton Lab., Chilton (UK). May 1990. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). In *Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.* Order Number DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

This paper reports some surprising results from work during muon-catalyzed fusion on the formation of dtμ muonic molecules. To their surprise the authors conclude that there are significant epithermal contributions to the steady-state molecular formation rates at 23 °K. Several theoretical perspectives are examined for an explanation. (U.K.).

50186 (RAL–90-022, pp. 32-34) **Experiment for direct measurement of final sticking ω_s in muon catalyzed dt fusion.** Petitjean, C. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)); Lou, K.; Ackerbauer, P. Rutherford Appleton Lab., Chilton (UK). May 1990. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). In *Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.* Order Number DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

Maximum fusion output from muon-catalyzed fusion seems to be limited by muon-alpha sticking. New experiments to measure the sticking probability directly are described in this paper. The method is based on measuring the charge produced by alphas or muon-alphas in an ionization chamber, and on simultaneous detection of 14 MeV neutrons associated with dt fusion using plastic scintillation counters. This experiment measures the sticking probability to 5% absolute precision, and produced valuable information about mesomolecular formation rates. (U.K.).

50187 (RAL–90-022, pp. 42-44) **New results in muon catalyzed pd fusion.** Petitjean, C. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)); Lou, K.; Ackerbauer, P. Rutherford Appleton Lab., Chilton (UK). May 1990. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). In *Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.* Order Number DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

Experiments to achieve a better understanding of the kinetics of pμd muon-catalyzed fusion are described. Mixtures of liquid protium and deuterium in various concentrations were examined at 20 °K. The 5.5 MeV gammas, characteristic of pμd fusion were detected using a high resolution Germanium diode. A method of combine measurement of pd and dd channels allows several parameters to be determined simultaneously, namely μd populations, μd spin transitions, pμd formation and pμd fusion. (U.K.).

50188 (RAL–90-022, pp. 45-46) **Emission of muonic hydrogen isotopes from solid hydrogen layers into vacuum.** Marshall, G.M. (TRIUMF, Vancouver, BC (Canada)); Bailey, J.M.; Beer, G.A. Rutherford Appleton Lab., Chilton (UK). May 1990. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). In *Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.* Order Number DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

An attempt has been made to create in a vacuum free muonic hydrogen atoms, muonic protium (μ^-p) and muonic deuterium (μ^-d)* in order to isolate specific processes unambiguously and thus contribute to a better understanding of muon-catalyzed fusion, muon capture and quantum electrodynamics. A beam of negative muons is slowed in a layer of solid hydrogen in vacuum frozen to a cold gold foil substrate. Several possibilities for the exploitation of muonic hydrogen emission are examined. (U.K.).

50189 (RAL–90-022, pp. 47-48) **Diffusion of muonic hydrogen atoms.** Kraiman, J.B. (College of William and Mary, Williamsburg, VA (USA)); Chen, G.; Guss, P.P. Rutherford Appleton Lab., Chilton (UK). May 1990. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). In *Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.* Order Number DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

An experiment is described to measure two main quantities which govern the kinetic energies of muonic hydrogen atoms, the initial kinetic energy distribution of muons after the cascade and cross sections for the spins of the muonic atoms. This information will allow muon-catalyzed fusion to be better understood, as the energy distribution of muonic atoms during the catalysis cycle is known. Muons are stopped in a gaseous hydrogen target into which an array of planar foils is immersed. (U.K.).

50190 (RAL–90-022, pp. 52-53) **Rotational and temperature effects on Coulomb capture of muons by hydrogen molecules.** Korenman, G.Ya. (Moskovskij Gosudarstvennyj Univ., Moscow (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Leonova, S.V.; Popov, V.P.; Dolinov, V.K. Rutherford Appleton Lab., Chilton (UK). May 1990. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). In *Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.* Order Number DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

A general approach to the theory of slow muon-molecule collisions is developed in this paper, taking molecular rotation and vibration into account. Kinetic characteristics of Coulomb-capture can be influenced by temperature due to dependence of the averaged cross-sections. This effect is calculated for the relative probabilities of muon Coulomb capture in the (H_2 + He) and (H_2 + D_2) mixtures. (U.K.).

50191 (RAL–90-022, pp. 54-55) **Kinetics of the excited mesic hydrogen in the mixture of hydrogen isotopes.** Gula, A. (Institute of Physics and Nuclear Techniques, Cracow (Poland)); Kravtsov, A.; Popov, N. Rutherford Appleton Lab., Chilton (UK). May 1990. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). In *Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.* Order Number DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

This experimental study of muon transfer in different deuterium and tritium mixtures allow the theory of muon-catalyzed fusion to be verified and the efficiency of muon catalysis to be estimated. The calculated values of the ground state population of mesic deuterium for a protium-deuterium mixture are presented. It may also be determined using muon polarization studies in protium-deuterium mixtures. The problems associated with the poisoning of the hydrogen target by helium from nuclear fusion and tritium decay are also noted. (U.K.).

50192 (RAL–90-022, pp. 69) **Accuracy-weighted variational principle for degenerate continuum states.** Danos, M. (National Inst. of Standards and Technology, Gaithersburg, MD (USA)). Rutherford Appleton Lab., Chilton (UK). May 1990. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). In *Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.* Order Number DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

This paper offers a numerical solution for Schroedinger's equation as it applies to continuum states using the Ritz method for use in studying muon-catalyzed fusion. The accuracy of the solution is maximized in pre-selected regions of space. The method allows the selection of a solution that is needed to a particular application from the infinitely degenerate solution set. (U.K.).

50193 (RAL–90-022, pp. 72) **μCF studies in University of Tsukuba.** Ishihara, T. (Tsukuba Univ., Ibaraki (Japan). Inst. of Physics); Hara, S. Rutherford Appleton Lab., Chilton (UK). May 1990. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). In *Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.* Order Number DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

Three topics are discussed which are being studied at the University of Tsukuba in Japan in relation to muon-catalyzed fusion research. Variational calculations for the binding energies of muonic molecules were carried out by adopting spheroidal coordinates. This is found to work well even for weakly bound states. Adiabatic potential curves and non-adiabatic coupling terms were calculated for the low lying states of the $(dt\mu)^+$ molecule. Bound-state energies of the even-parity muonic molecules with total angular momentum, J=1 were also calculated. A new approach is offered for muon transfer in low energy rearrangement collision in the Coulomb three-body problem. In addition $d\mu$ + t collisions were

studied at thermal energies. Lifetime studies on some muonic molecules were also carried out. (U.K.).

50194 (RAL–90-022, pp. 73-74) **Resonances in muonic systems.** Hu, C.Y. (California Univ., Los Angeles, CA (USA). Dept. of Physics); Bhatia, A.K. Rutherford Appleton Lab., Chilton (UK). May 1990. Grant RII8721929. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). In *Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.* Order Number DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

Feshbach-type or closed-channel resonances have been found to have stabilized roots for muonic systems such as $t\mu$ or $d\mu$. From their results, the authors conclude that when there is more than one open channel a root which seems to be stabilized close to the threshold could tend to the threshold as the number term is increased, indicating the absence of a resonance. No resonances are found above the n=1 threshold of $d\mu$, but they are found below the n=2 threshold of $d\mu$ and $t\mu$. (U.K.).

50195 (RAL–90-022, pp. 79-80) **Phase space, meson exchange and the photon connection in sticking.** Chatterjee, L. (Jadavpur Univ., Calcutta (India). Dept. of Physics). Rutherford Appleton Lab., Chilton (UK). May 1990. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). In *Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.* Order Number DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

This paper deals with various aspects of alpha-muon sticking in muon-catalyzed d-t fusion. The sticking factor has been interpreted as a branching ratio and computed using the rates for stuck and continuum states with proper phase space integrations. Meson exchange diagrams are thought to contribute to the understanding of stuck and continuum matrix elements. By introducing proper two and three body final state phase space factors, the relevant rates can be used for computed sticking. (U.K.).

50196 (RAL–90-022, pp. 84-85) **Angular-momentum alignment effects under slowing-down of muonic helium ion in the μ CF.** Balashov, V.V. (Moskovskij Gosudarstvennyj Univ., Moscow (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Dolinov, V.K.; Konovalov, D.A.; Shakirov, V.A. Rutherford Appleton Lab., Chilton (UK). May 1990. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). In *Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.* Order Number DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

A group of Soviet scientists report on a theoretical investigation of the effects of angular momentum alignment under the slowing-down of muonic helium ions during muon-catalyzed fusion. The slowing-down cascade processes were studied and the close-coupling method was used to calculate collision-induced transitions between the $He\mu^+$ states. The effective sticking probability is calculated by considering muon regeneration during the slowing down process. (U.K.).

50197 (RAL–90-022, pp. 103-104) **Cold fusion in palladium: the experimental results from PSI.** Blaser, J.P. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)); Haas, O.; Petitjean, C. Rutherford Appleton Lab., Chilton (UK). May 1990. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). In *Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.* Order Number DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

Following the 1989 claim to have produced cold fusion by catalyzing deuterium in heavy water electrolysis on palladium cathodes, a programme of experiments was set up at the Paul Scherrer Institute, and is here reported, which aimed to verify the claim. No evidence of excess heat was observed, nor were fusion neutrons or gamma rays. No excess levels of ^3He or ^4He were found in the palladium which could be attributed to fusion, and tritium traces corresponded only to the original contamination rates. In short, no evidence for cold fusion was found. (U.K).

50198 (RAL–90-022, pp. 105-107) **The non-observation of cold nuclear fusion in electrolytic cells stimulated by high intensity stopped muons and pions.** Davies, J.D. (Birmingham Univ. (UK). School of Physics and Space Research); Anderson, A.N.; Alper, B. Rutherford Appleton Lab., Chilton (UK). May 1990. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). In *Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.* Order Number DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

This paper reports on tests, for palladium and titanium cathodes, for two of the many theoretical models that aim to reduce Coulomb tunneling lifetimes in order to explain claimed observations of cold fusion during the electrolysis of D_2O using these two elements as cathodes. The ISIS facility at the Rutherford Appleton Laboratory provided the high stopping intensity and very low, delayed-background of its pulsed muon/pion beam. The authors conclude that cosmic ray muon fluxes claimed by previous workers are insufficient to explain the observed fusion neutron rate. Other effects, of the spread of energy hot spots, are also explained, and claims for cold fusion are thus not verified. (U.K.).

50199 (RAL–90-022, pp. 108-109) **Cold fusion and tritium.** Cohen, J.S. (Los Alamos National Lab., NM (USA)); Davies, J.D. Rutherford Appleton Lab., Chilton (UK). May 1990. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). In *Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.* Order Number DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

The authors examine recent and prospective experimental data relating to claimed observations of cold fusion from electrolysis of D_20 with palladium or titanium cathodes. Experiments with tritium may prove a decisive test of the cold or hot fusion debate, and indeed may allow different mechanisms of hot fusion to be decided upon. Safety considerations must be weighed very carefully as tritium is very radioactive and easily exploded with a wide range of oxygen concentrations. The authors urge fellow scientists to produce more reproducible results at statistically significant levels, but suggest that some null results for microscopically hot fusion neutron detection may be a result of choice and treatment of the alloy selected. (U.K.).

50200 (RAL–90-022, pp. 111-113) **Response to queries regarding "Observation of cold nuclear fusion in condensed matter".** Jones, S.E. (Brigham Young Univ., Provo, UT (USA). Dept. of Physics and Astronomy); Czirr, J.B.; Decker, D.L.; Jensen, G.L.; Palmer, E.P. Rutherford Appleton Lab., Chilton (UK). May 1990. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). In *Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.* Order Number DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

One of the first teams of scientists, who claimed to have observed cold fusion, respond in this paper to some of the criticisms levelled against their work, focusing on care with neutron detection, and interpretation of results, and precautions taken to try to eliminate systematic error such as cosmic ray neutrons being miscounted as fusion products. (U.K.).

50201 (RAL–90-022, pp. 114-116) **On the criteria followed in the Gran Sasso measurement on cold nuclear fusion.** Bertin, A. (Bologna Univ. (Italy). Ist. di Fisica); Bruschi, M.; Capponi, M. Rutherford Appleton Lab., Chilton (UK). May 1990. (CONF-8909262–: International symposium on muon catalyzed fusion μCF - 89, Oxford (UK), 10-13 Sep 1989). In *Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989.* Order Number

DE90706209. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

The criteria, under which measurements to reproduce cold fusion were performed, are detailed in this paper in order to eliminate erroneous interpretation of the Gran Sasso group's work by other scientists. Systematic and statistical improvements to the experimental set up are planned. The difficulties of detecting fusion produced neutrons and energy release from gamma rays is examined and the authors restate their claim for low-level cold nuclear fusion observations. (U.K.).

50202 (SAND–90-1346C) **Intense ion beam transport in neutral gas.** Olson, C.L. Sandia National Labs., Albuquerque, NM (USA). [1990]. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9009200–14: 1990 LINAC conference, Albuquerque, NM (USA), 10-14 Sep 1990). Order Number DE91000026. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

An analysis is made of the gas breakdown that occurs when an intense ion beam is injected into neutral gas and a high electrical conductivity is produced, providing charge and current neutralization for beam transport.

99 GENERAL AND MISCELLANEOUS

9901 Management

Refer also to citation(s) 48977

50203 (KEK-PR–89-3) **Photon Factory activity report, 1989.** National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). 1990. 428p. Order Number DE90520234. Source: NTIS (US Sales Only), PC A19/MF A01.

At the Photon Factory about 500 experiments are now running annually with about 50 experimental stations, the total operation time of the 2.5 GeV storage ring was 3400 hour in 1989, and the number of users was more than 2000, including 300 scientists from industry. This wide usage of synchrotron radiation has been supported by good performance of the accelerators. The positron beam current of the linac was increased for rapid injection (injection time: 20 min). The entire roof of the Light Source building was covered with thermal insulator (urethane-foam). This has greatly improved the beam stability of the ring. It has been operated at an initial ring current of 350 mA with a life time of 20 hours. Distinctive instrumentation at the Photon Factory has expanded to various fields such as angle-resolved ion-spectroscopy, dispersive EXAFS, trace impurity X-ray fluorescence analysis, plane-wave topography, structure analysis under high pressure, and imaging plates. Recently, experiments of protein structure analysis have been carried out extensively; Sakabe developed a new type of Weissenberg camera for protein crystallography, and about 50 experiments have been done for the past six months by a combination of Sakabe camera and imaging plates. The 2.5 GeV light source is now at an entrance of its harvest season. The TRISTAN Accumulation Ring has been used throughout this year in a time sharing basis with the TRISTAN experiment; twenty minutes for injection to TRISTAN Main Ring and 2 hours for SR experiment. The main subject has been magnetic Compton scattering with circularly polarized wiggler radiation. Such experiences enable us to expand our perspective for research in the following decade; we are investigating the possibility of operating the TRISTAN Main Ring at 6-8 GeV with 6000-pole undulaters, resulting in an extremely brilliant radiation source (Emittance: 0.1 nm·rad at 5 GeV with damping rings).

50204 (NIRS–26) **Annual report of National Institute of Radiological Sciences, April 1986 - March 1987.** National Inst. of Radiological Sciences, Chiba (Japan). Jul 1987. 118p. Order Number DE90520444. Source: NTIS (US Sales Only), PC A06/MF A01.

The Annual Report of April 1986-March 1987 provides the information on up-to-date research activities of the National Institute of Radiological Sciences (NIRS) in Japan. Researches undertaken in the NIRS aim at promoting medical application of radiation and at investigating health effects of radiation and radiation protection especially for the medical purpose. The research scope is therefore widely ranging from physics to genetics and from environmental science to clinical medicine. In addition to basic researches carried out by 14 research divisions, the following longterm projects which were organized by scientists recruited from several divisions are currently in progress: (1) biological effects of tritium; (2) stochastic effects of radiation and risk estimation; (3) assessment of human exposure to environmental radiation; and (4) medical use of accelerated heavy ions. This volume is divided into the following scientific categories for ease of reader's understanding: physics, chemistry, biochemistry and biophysics, cell biology, immunology and hematology, pathology and physiology, genetics, clinical research, and environmental science, covering a total of 97 titles. Activities of each research division and organization of the NIRS are given in Appendices. (N.K.).

50205 (NIRS–27) **Annual report of National Institute of Radiological Sciences, April 1987 - March 1988.** National Inst. of Radiological Sciences, Chiba (Japan). Jul 1988. 118p. Order Number DE90520443. Source: NTIS (US Sales Only), PC A06/MF A01.

The Annual Report of April 1987-March 1988 provides the information on up-to-date research activities of the National Institute of Radiological Sciences (NIRS) in Japan. Researches undertaken in the NIRS aim at promoting medical application of radiation and at investigating health effects of radiation and radiation protection. The research scope is therefore widely ranging from physics to genetics and from environmental science to clinical medicine. In addition to basic researches carried out by 14 research divisions, the following three longterm projects which were organized by scientists recruited from several divisions are currently in progress: (1) stochastic effects of radiation and risk estimation; (2) assessment of human exposure to environmental radiation; and (3) medical use of accelerated heavy ions. Projects (1) and (2) were finalized in this fiscal year. This volume is divided into the following scientific categories for ease of reader's understanding: physics, chemistry, biochemistry and biophysics, cell biology, immunology and hematology, pathology and physiology, genetics, clinical research, and environmental science, covering a total of 93 titles. Activities of each research division and organization of the NIRS are given in Appendices. (N.K.).

50206 (NIRS-AR–31) **Annual report of National Institute of Radiological Sciences of the fiscal year 1987.** National Inst. of Radiological Sciences, Chiba (Japan). Dec 1988. 252p. (In Japanese). Order Number DE90520440. Source: NTIS (US Sales Only), PC A12/MF A01.

This annual report presents the activities of the National Institute of Radiological Sciences in Japan in the fiscal year 1987. The activities are divided into research, technical aids, training, medical services, management, library or editing, and international cooperation. Research activities are described under the following sections: (1) 5-year special projects concerning 'stochastic effects of radiation and risk estimation', 'assessment of human exposure to environmental radiation' and 'medical use of accelerated heavy ions'; (2) 6 titles in assigned research; (3) 60 titles in ordinary research covering physics, chemistry, biology, genetics, pathology and physiology, cell biology, internal exposure, environmental science, clinical research, clinical research for radiation injuries, medical use of heavy particles, environmental radiation ecology, and aquatic radiation ecology; (4) risk estimation of radiation; (5) actual surveys for Bikini victims, population doses of medical and occupational exposure, and thorotrast exposure; (6) project research; (7) radioactivity survey; (8) research supported by Science and Technology Agency aids. An outline of technical aids is given in terms of technical services, radiation safety, animal and plant management, and cyclotron management. Appendices give publications, organization, and staff. (N.K.).

50207 (OUP–90-10) **Section for nuclear physics and energy physics - Annual report 1989: January 1 - December 31, 1989.** Oslo Univ. (Norway). Fysisk Inst. Apr 1990. 83p. Order Number DE91602692. Source: NTIS (US Sales Only), PC A05/MF A01; OSTI; INIS.

The experimental activities in nuclear physics have in 1989 mainly been centered around the cyclotron laboratory with the Scanditronic MC-35 cyclotron. The installation of the CACTUS multidetector system has been completed. With 8 particle telescopes,

28 NaI detectors and 2 Ge detectors, this experimental arrangement represents a major improvement compared to earlier set-ups in the laboratory. Theoretical studies of manybody problems, and nuclear structure and reactions have continued. The study of problems related to the foundations of quantum mechanics has also been persued.

50208 (UJV–9040-V) **List of publications 1989.** Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia). Jan 1990. 57p. (In Czech, English). Order Number DE91602691. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

A list is given of reports, journal articles (published or submitted for publication), theses, conference papers, patents, and reports for internal use, published in 1989 by staff members of the Nuclear Research Institute in Rez, Czechoslovakia. (P.A.).

9902 Mathematics and Computers

Refer also to citation(s) 48226, 48229, 48231, 48237, 48280, 48308, 48318, 48324, 48328, 48342, 48347, 48354, 48358, 48360, 48364, 48365, 48366, 48368, 48373, 48392, 48393, 48394, 48411, 48443, 48463, 48527, 48581, 48587, 48594, 48595, 48596, 48597, 48612, 48644, 48646, 48658, 48659, 48660, 48664, 48668, 48686, 48699, 48749, 48751, 48771, 48772, 48773, 48783, 48793, 48794, 48795, 48808, 48809, 48810, 48836, 48839, 48870, 48886, 48953, 48987, 49043, 49046, 49068, 49071, 49072, 49108, 49115, 49116, 49117, 49118, 49119, 49120, 49145, 49157, 49163, 49164, 49166, 49169, 49176, 49177, 49190, 49218, 49219, 49220, 49254, 49256, 49269, 49270, 49271, 49272, 49274, 49281, 49318, 49332, 49334, 49336, 49337, 49363, 49368, 49375, 49379, 49380, 49382, 49386, 49391, 49394, 49400, 49462, 49589, 49644, 49651, 49652, 49702, 49732, 49733, 49880, 49881, 49893, 49896, 50052, 50053, 50054, 50085, 50088, 50091, 50103, 50177, 50178, 50255

50209 (AD-A–222466/5/XAB) **Supercomputer work-station communication. Special report.** Katz, A.; Casner, S. University of Southern California, Marina Del Rey, CA (USA). Information Sciences Inst. Jun 1989. 27p. Contract MDA903-87-C-0719. (ISI/SR–89-235). Source: NTIS, PC A03/MF A01.

This is the final report of the Supercomputer Workstation Communication (SWC) project. The project explored new techniques for using high-capacity networks to communicate between personal workstations and remote supercomputers. The effort involved evaluation and testing of standard IP/TCP-based protocols, as well as newer remote window protocols such as MIT's X Window System and Sun Microsystems' NeWS. The DARPA Wideband Satellite Network provided the high-capacity, long-distance communication path for many of these tests. Additional areas of research included a preliminary study of a proposed Intelligent Communication Facility and an investigation of the current and future user requirements of the scientific community that will use supercomputers.

50210 (AD-A–222798/1/XAB) **Superconcurrent processing: A dynamic approach to heterogeneous parallelism. Final report.** Freund, R.F. Naval Ocean Systems Center, San Diego, CA (USA). Mar 1990. 19p. (NOSC/TD–1781). Source: NTIS, PC A03/MF A01.

There is a growing concensus among supercomputer scientists that super-speed computers of the future will be parallel processors, since the traditional vector processors are only able to pipeline out one or a few results per cycle. Parallel processors and the parallel machines were in such an experimental state that it still made sense to look to vector processing for practical supercomputing. Both of those conditions are changed today, providing computational scientists with the occasion to begin to realize the full power of parallel processing. As we start to do this, however, we realize that while vector processors are basically all very similar to each other, parallel architectures present a wide variety of types. It seems quite unlikely that one of these types will be ideal for a wide range of types. It seems quite unlikely that one of these types will be ideal for a wide range of problems. For that reason, a number of computational scientists are looking at distributed heterogeneous processing as a potential solution. Superconcurrency is one approach to this form of computing.

50211 (AD-A–223072/0/XAB) **Language support for parallel computation. Final report, September 1988-September 1989.** Ramamoorthy, C.V. California Univ., Berkeley, CA (USA). Computer Science Div. Apr 1990. 212p. Contract F30602-88-D-0027. Source: NTIS, PC A10/MF A02.

This final technical report summarizes the research accomplished under the Expert Science and Engineering (ES&E) program by the University of California at Berkeley through Syracuse University. The research effort, entitled Parallel Extensions for Object Oriented Programming, examined communication aspects leading to language support for parallel computation. The work undertaken in this effort has extended concurrent programming languages in their communication primitives. Although many abstraction mechanisms have been used in programming languages, including control abstraction mechanisms (such as procedures) and data abstraction mechanisms (such as data types), communication abstraction mechanisms have been found to be the most useful for parallel/concurrent programming paradigms. Work accomplished in this effort has extended those mechanisms, concentrating on interprocess communication. A formal model for concurrent systems, called the Synchronous Token-based Communicating State (STOCS) model, has been used to model and analyze concurrent systems. Since present concurrent languages do not support any form of analysis of the communication structure of programs, two new constructs based on STOCS formalism have been developed to support high level specification - handshake and unit. A fair and efficient algorithm for execution of multi-process shared events is also presented.

50212 (ANL/TM–423-Rev.2) **Conversational Monitor System (CMS) at Argonne National Laboratory (ANL): Revision 2.** Hull, W.E. (ed.); Thommes, M.M.; Gallo, M.A. Argonne National Lab., IL (USA). Aug 1990. 61p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE90018020. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report is a manual on using CMS on the IBM 3084 at Argonne National Laboratory. The chapters within include: getting started; getting help and information; managing your minidisks; using local utility execs; transferring files between CMS and no other computers; using CMS electronic mail at ANL; using magnetic tapes in CMS; programming in CMS; using software available at ANL in CMS; using the z-disk user-contributed software; and submitting batch jobs from CMS.

50213 (CONF-901101–24) **Parallel performance models for the nodal transport method on the hypercube.** Azmy, Y.Y. Oak Ridge National Lab., TN (USA). [1990]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From American Nuclear Society winter meeting; Washington, DC (USA); 11-15 Nov 1990. Order Number DE90015162. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In this paper, we derive and validate a parallel performance model for a previously derived parallel algorithm used in solving the nodal transport method equations with zero- and first-order spatial approximations.

50214 (CONF-901150–1) **A unified framework for credit assignment.** Liepins, G.E. (Oak Ridge National Lab., TN (USA)); Sutton, R.S. Oak Ridge National Lab., TN (USA). [1990]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From IEEE conference on neural information processing: natural and synthetic; Denver, CO (USA); 26-29 Nov 1990. Order Number DE90011636. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Credit assignment is a central issue in a variety of connectionist paradigms including artificial neural networks and genetic classifier systems. For neural networks, credit assignment is implicit in the training algorithms used to update connection weights. In classifier systems, it is used to estimate rule strengths. This paper introduces a unifying framework that covers and helps explain the differences and similarities between a large number of approaches to credit assignment, including Q-learning, policy iteration, bucket brigade and profit sharing. Each of these can be formulated as a version of the Adaptive Heuristic Critic (AHC). 11 refs.

50215 (CONF-9002131–3) **Symbolic manipulation software and the study of differential equations.** Garbey, M.; Kaper, H.G.; Kwong, Man Kam. Argonne National Lab., IL (USA). 25 Jul 1990. 25p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Workshop on asymptotic analysis and numerical solution of partial differential equations; Argonne, IL (USA); 26-28 Feb 1990. Order Number DE90017674. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this note we describe some of our experiences with symbolic manipulation software for the analysis of differential equations. We give several examples from our work on semilinear diffusion equations and from a bifurcation analysis of a nonlinear problem in combustion. 25 refs.

50216 (FNAL-TM–1679) **CANVAS: C++ objects for easy graphics on an Evans and Sutherland PS390 terminal: User's guide.** Michelotti, L.; Kick, R. Fermi National Accelerator Lab., Batavia, IL (USA). 27 Aug 1990. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. Order Number DE90018018. Source: NTIS, PC A03/MF A01 - OSTI.

The C++ classes described in this note comprise an attempt to provide an object-oriented approach, and if there was ever a graphics terminal naturally suited to object-oriented programming, the PS390 is it. Since a canvas is not a program but a variable to be used in programs, users can write software to suit their particular needs. By simply declaring canvas variables the application program is provided with an object which accepts data and displays it automatically. Any number of canvases can be placed anywhere on the screen, so data can be viewed in a variety of ways simultaneously. Further, the "real-time" transformation capabilities of the PS390 are activated in one step by "connecting" its external devices, the dials and the puck, to the desired canvas. There is no need for the applications programmer to construct his own function networks, choose names for nodes, and do any of the other administrative tasks laid out in the manuals, including connecting the terminal to a host computer and initializing it. These are handled automatically by the canvases themselves, thus removing this clutter from the application program.

50217 (IFVE-OP–89-129) **Distributed computer system based on local area network ALISA in experimental investigations.** Kazakov, P.N.; Kardanev, A.B.; Sakharov, V.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1989. 12p. (In Russian). Order Number DE91602599. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A brief analysis of features construction of distributed computer system based on the Local Area Net (LAN) in the automized control of experimental investigations is given. The main characteristics of LAN hardware and ALISA software are presented. The realization of the distributed computer structure for automized experimental setups using CAMAC is described. 3 refs.

50218 (INS-T–496) **KODAQ (Kakuken On-line Data Acquisition System) based on PC-9801 personal computer.** Omata, Kazuo; Fujita, Yuzo. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Apr 1990. 38p. (In Japanese). Order Number DE90520261. Source: NTIS (US Sales Only), PC A03/MF A01.

A new software KODAQ (Kakuken On-line Data AcQuisition system) has been developed. The system is designed to take data with CAMAC, crate controller, input/output modules and interrupt module are necessary as a standard hardware setup, and PC-9801 personal computer. The functions of the system are defined by two files. One is KODAQ command file, and the other is CAMAC configuration/monitoring file written in a C language. These two files can easily be rewritten to fulfill the various experimental requirements. Except for a part of high-speed processing of input data, users can define computer resources and their functions logically. For this reason users can describe the system in simple and easy expressions. Useful functions are defined as a basic command and some of the commands are controlled with special function keys of PC-9801. Moreover the system can be easily extended using a command redefinition function. In this report, we describe the procedure for operating the system and the KODAQ commands. (author).

50219 (ITEF–88-89) **GITTAM program for numerical simulation of one-dimensional targets TIS. Part 2: 2. Description of algorithm and program.** Arpishkin, Yu.P.; Basko, M.M.; Sokolovskij, M.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1989. 28p. (In Russian). Order Number DE91602685. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A finite-difference algorithm for numeric solution of a system of one-dimensional hydrodynamics equation with heat conductivity, radiation diffusion and thermonuclear combustion is considered. The algorithm presented allows one to simulate one-dimensional thermonuclear targets for heavy-ion synthesis (HIS), irradiated with heavy ion beams. A brief description of a complex of GITTAM programs in which finite-difference algorithm for one-dimensional thermonuclear HIS target simulation is used, is given. 5 refs.; 3 figs.

50220 (IYaF–88-23) **Software for the ODRA and ODRENOK computers; programs for text file processing.** Kozak, V.R. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 35p. (In Russian). Order Number DE91602686. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Text editor EDIT, text processor GIRL text printing programs using standard (KISS) and arbitrary (PRIN) type faces, device for copying from a graphic display to graphic LDZM printer are described. Text file structure for ODRA and ODRENOK. Computers, features of the described program developing are described. The appendix presents descriptions of all the programs, intended for the user. 5 refs.; 1 tab.

50221 (JAERI-M–90-068) **Monte Carlo codes and Monte Carlo simulator program.** Higuchi, Kenji (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Asai, Kiyoshi; Suganuma, Masayuki. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 68p. (In Japanese). Order Number DE90520265. Source: NTIS (US Sales Only), PC A04/MF A01.

Four typical Monte Carlo codes KENO-IV, MORSE, MCNP and VIM have been vectorized on VP-100 at Computing Center, JAERI. The problems in vector processing of Monte Carlo codes on vector processors have become clear through the work. As the result, it is recognized that these are difficulties to obtain good performance in vector processing of Monte Carlo codes. A Monte Carlo computing machine, which processes the Monte Carlo codes with high performances is being developed at our Computing Center since 1987. The concept of Monte Carlo computing machine and its performance have been investigated and estimated by using a software simulator. In this report the problems in vectorization of Monte Carlo codes, Monte Carlo pipelines proposed to mitigate these difficulties and the results of the performance estimation of the Monte Carlo computing machine by the simulator are described. (author).

50222 (KCP–613-4118) **Software quality assurance handbook.** Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div. Sep 1990. 79p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00613. Order Number DE91000060. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

There are two important reasons for Software Quality Assurance (SQA) at Allied-Signal Inc., Kansas City Division (KCD): First, the benefits from SQA make good business sense. Second, the Department of Energy has requested SQA. This handbook is one of the first steps in a plant-wide implementation of Software Quality Assurance at KCD. The handbook has two main purposes. The first is to provide information that you will need to perform software quality assurance activities. The second is to provide a common thread to unify the approach to SQA at KCD. 2 figs.

50223 (KEK–89-26, pp. 183-200) **Advanced computer program (ACP) at KEK.** Yasu, Yoshiji (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1990. (CONF-8903226–: Symposium on data acquisition and processing for next generation experiments, Tsukuba (Japan), 9-10 Mar 1989). In *Proceedings of symposium on data acquisition and processing for next generation*

experiments. Order Number DE90508151. Source: NTIS (US Sales Only), PC A11/MF A01.

The paper describes what is the ACP, the performance and the next generation of ACP. The first generation of ACP is being used at KEK for studying parallel processing and actual job like physics simulations while it's used at many laboratories of high energy physics in the world. Then, the next generation of ACP is being developed for getting more high performance. (author).

50224 (LA-UR–90-2564) **Performance evaluation of the IBM RISC [reduced instruction set computer] System/6000: Comparison of an optimized scalar processor with two vector processors.** Simmons, M.L.; Wasserman, H.J. Los Alamos National Lab., NM (USA). [1990]. 11p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-901121–5: Association for Computing Machinery/Institute of Electrical and Electronics Engineers supercomputing conference, New York, NY (USA), 12-16 Nov 1990). Order Number DE90015058. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

RISC System/6000 computers are workstations with a reduced instruction set processor recently developed by IBM. This report details the performance of the 6000-series computers as measured using a set of portable, standard-Fortran, computationally-intensive benchmark codes that represent the scientific workload at the Los Alamos National Laboratory. On all but three of our benchmark codes, the 40-ns RISC System was able to perform as well as a single Convex C-240 processor, a vector processor that also has a 40-ns clock cycle, and on these same codes, it performed as well as the FPS-500, a vector processor with a 30-ns clock cycle. 17 refs., 2 figs., 6 tabs.

50225 (LA-UR–90-2577) **A Monte Carlo boundary propagation method for the solution of Poisson's equation.** Hiromoto, R.; Brickner, R.G. Los Alamos National Lab., NM (USA). [1990]. 6p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-901101–22: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE90015060. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

To often the parallelism of a computational algorithm is used (or advertised) as a desirable measure of its performance. That is, the higher the computational parallelism the better the expected performance. With the current interest and emphasis on massively parallel computer systems, the notion of highly parallel algorithms is the subject of many conferences and funding proposals. Unfortunately, the "revolution" that this vision promises has served to further complicate the measure of parallel performance by the introduction of such notions as scaled speedup and scalable systems. As a counter example to the merits of highly parallel algorithms whose parallelism scales linearly with increasing problem size, we introduce a slight modification to a highly parallel Monte Carlo technique that is used to estimate the solution of Poisson's equation. This simple modification is shown to yield a much better estimate to the solution by incorporating a more efficient use of boundary data (Dirichlet boundary conditions). A by product of this new algorithm is a much more efficient sequential algorithm but at the expense of sacrificing parallelism. 3 refs.

50226 (LBL–26455, pp. 133) **Theory of atomic and molecular collision processes.** Miller, W.H. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

This research is primarily involved with the development and application of theoretical methods and models for describing atomic and molecular collision processes and chemical reaction dynamics. Specific topics of interest have included the theory of inelastic and reactive scattering, collision processes involving electronically excited atoms or molecules, collisional ionization phenomena, statistical theories of chemical reactions, scattering of atoms and molecules from surfaces, and the interactions of molecular systems with high-power laser radiation. Most recently, research has focused on the development of theoretical methods for a first-principles treatment of dynamics in polyatomic molecular systems. The goal is to develop approaches that can utilize ab initio quantum chemical calculations of the potential energy surface (in the Born-Oppenheimer approximation) as direct input into the dynamical treatment, and thus, to as great an extent as possible, have a truly predictive theory. The potential application of these methods is almost without limit. In this group hydrogen-atom transfer processes have been studied in a variety of systems. Other research groups have used these approaches to describe a variety of reactions that are relevant to the primary steps in combustion.

50227 (LBL–26455, pp. 133) **Monte Carlo path integration for the real-time propagator.** Makri, N.; Miller, W.H. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

Monte Carlo methods are described for evaluating the Feynman path-integral representation of the (real-time) propagator (time-evolution operator), $\exp(-iHt/h)$. The approach is based on the modified Filinov algorithm presented earlier by Makri and Miller. Numerical calculations are presented for time evolution in a symmetric double-well potential, as well as in a Morse potential.

50228 (LBL–26455, pp. 133) **Effect of fluctuations in state-specific unimolecular rate constants on the pressure dependence of the average unimolecular reaction rate.** Miller, W.H. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The standard (i.e., Lindemann mechanism, strong-collision assumption, etc.) treatment of thermal unimolecular reactions expresses the effective, pressure-dependent unimolecular rate constant (usually called k_{uni}) in terms of the average unimolecular rate constant for a given total energy, k(e) (and, more rigorously, for a given total angular momentum). Several experimental and theoretical studies have shown, however, that unimolecular rate constants for individual quantum states (all of essentially the same total energy and angular momentum) can have significant variations about the average rate, i.e., a significant degree of state specificity. This paper examines the effect that these fluctuations have on the effective, pressure-dependent rate, k_{uni}. The general result is that fluctuations reduce the rate, most prominently at high pressures.

50229 (LBL–26455, pp. 133-134) **A diabatic reaction-path Hamiltonian.** Miller, W.H.; Ruf, B.A.; Chang, Y.T. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A reaction-path Hamiltonian is constructed that is based on a straight-line, least-motion path that interpolates linearly between equilibrium reactant and product geometries of the molecular systems. Conservation of linear and angular momentum are correctly accounted for. The resulting Hamiltonian has a Cartesian-type kinetic energy, the coriolis coupling terms originally present in the kinetic energy having been transformed to potential energy coupling (hence the term diabatic reaction-path Hamiltonian). Curvature-coupling terms that appears in the original reaction-path Hamiltonian, which is based on the minimum-energy reaction path, are absent here because the present reaction path is straight. This new, diabatic reaction-path Hamiltonian should be especially useful for describing H-atom transfer reactions in polyatomic systems, a case for which the minimum-energy reaction path provides a poor description.

50230 (LBL–26455, pp. 134) **Correct short-time propagator for Feynman path integration by power-series expansion in Δt.** Makri, N.; Miller, W.H. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

The most commonly used short-time propagator in a discretized Feynman path integral (and also several more sophisticated improved ones) is not correct through first order in the time increment Δt. The correct semiclassical result for the phase (i.e., the action) of the short-time propagator is developed in this paper as a power series in Δt, explicit expressions being given for the terms of order Δt^{-1}, Δt^{1}, and Δt^{3}. The proposed expression is also the correct quantum mechanical result through order Δt_2. Test applications to the standard harmonic oscillator and also to a double-well potential

(typical for intramolecular H-atom transfer) show the first-order propagator (i.e, the correct result through order Δt) to be a significant improvement over previous ones; inclusion of the third-order term gives considerable additional improvement (i.e., faster convergence).

50231 (LBL–26455, pp. 134-135) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A new kind of semiclassical tunneling model is being developed for use in classical trajectory simulations of polyatomic dynamical processes. Although much is known about rigorous semiclassical approximations to quantum mechanics, the goal of the present work is a simple-to-use, necessarily approximate model that can be implemented within the framework of a standard trajectory simulation. Applications to multidimensional models of H-atom transfer reactions show that such models can be usefully accurate.

50232 (LBL–26455, pp. 183) **Explicit approximations to the mean spherical approximation (MSA) for electrolyte systems with unequal ion sizes.** Harvey, A.H.; Copeman, T.W.; Prausnitz, J.M. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A systematic investigation is presented for explicit approximations to the MSA for ionic systems with ions of different size. Solution of the exact MSA for this case requires an implicit solution for the screening parameter; that implicit feature makes it particularly undesirable for use in iterative equation-of-state calculations. This work first compares with the exact MSA solution, an approximation based on a linear mixing rule for a single effective ion size, and second, a low-ion-density approximation due to Copeman and stein. These comparisons are for the electrostatic contributions to the Helmholtz energy, the pressure, and the chemical potentials because these quantities are of primary interest in phase-equilibrium calculations using an equation of state. Over a wide range of reduced temperatures, reduced densities, and ion-diameter ratios, the simple linear rule produces good results. However, for diameter ratios differing greatly from unity, better results are obtained at low ion densities from the method of Copeman and Stein. Comparison with published Monte Carlo data suggests that, when the MSA is used for the primitive model applied to aqueous electrolyte solutions, little error is introduced by the use of these approximations.

50233 (LBL–26455, pp. 127-128) **Damped-core quantum Monte Carlo: An effective treatment for large-z systems.** Hammond, B.L.; Reynolds, P.J.; Lester, W.A. Jr. Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

In the past several years increasing attention has focused on quantum Monte Carlo (QMC) methods for obtaining atomic, molecular, and chemical properties, including electronic structure. QMC is a method of solving the Schroedinger equation stochastically, and with suitable algorithms, exactly. Results obtained have been remarkably accurate and account explicitly for correlation effects. Recently, workers have begun to explore ways that treat only valence electrons motivated by the steep dependence on nuclear charge Z of the computation time required to reduce statistical uncertainties to the level of chemical accuracy. The core energy rises as Z^2, and, closely related, the time steps that may be taken in the simulations decrease as Z^2 due to the reduced phase space of the core electrons. In damped-core QMC the authors introduce a random-walk (QMC) method in which the core is treated separately from the valence space, although still by a Monte Carlo method, and valence energies are computed directly. The authors calculate ionization potentials and electron affinities of C, Si, and Ge, and find excellent agreement with experiment. Effective speedup over standard QMC approaches is estimated to be as large as a factor of 5,000.

50234 (LBL–26455, pp. 206-207) **Work in progress.** Lawrence Berkeley Lab., CA (USA). Jul 1989. In *Materials and Chemical Sciences Division annual report, 1988.* Order Number DE90003301. Source: NTIS, PC A11/MF A01.

A model that will permit the quantitative interpretation of experimental obervations of solid polymer electrolytes is being developed. More specifically, the model will help in determining fundamental transport properties from transient and steady-state experiments. A mathematical model of the Na/$FeCl_2$ battery has been developed. The model predicts the cell voltage as a function of the state of discharge and has been useful in showing porosity and volume fraction profiles and how they can affect cycle life. A model that uses Duhamel's theorem to simulate cyclic-voltammetry experiments at stationary and rotating-disk electrodes is being improved. Inductance effects found in high-power batteries are being investigated. Results from simplified and highly idealized systems have provided insight into how a realistic model should be developed. A mathematical model of the electrode/electrolyte interface is being developed to calculate the frequency response of a rotating disk. The algorithm accounts for the effect of surface coverage owing to specific adsorption and charge-transfer reactions. Ring-disk electrodes are being used to investigate porous ferrous sulfate films that form during the dissolution of iron in sulfuric acid solutions. A theoretical investigation of the growth and dissolution of salt films is under way. Laplace's equation arises in the description of many systems. Its solution is often expensive and difficult to obtain accurately. Tools are being developed that will facilitate its numerical solution. Additional work includes an experimental and theoretical impedance study of redox reactions in porous flow-through electrodes and studies of corrosion processes, with an emphasis on developing criteria for adequate corrosion protection.

50235 (MLM–3656(OP)) **Interfacing a personal computer to an analog scanning electron microscopy for storing images on optical disks.** Ransick, M.H.; Barklay, C.D. EG and G Mound Applied Technologies, Miamisburg, OH (USA). [1990]. 3p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-900877–7: 12. international congress for electron microscopy, Seattle, WA (USA), 12-18 Aug 1990). Order Number DE91000016. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Short communication. SCANNING ELECTRON MICROSCOPY/ image processing; PERSONAL COMPUTERS; EQUIPMENT INTERFACES; IMAGES; OPTICAL EQUIPMENT; MEMORY DEVICES; DIGITIZERS; IBM COMPUTERS

50236 (NEI-FI–119) **An information system for 20 kV electricity distribution networks integrated to telecontrol and automation.** Etula, H.J. (Espoon Saehkoe, Espoo (Finland)); Lakervi, E.; Kaerkkaeinen, S.; Haemaelaeinen, P. Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto. 1989. 84p. (In Finnish). Project KTM-202/881/85. Order Number DE90518708. Source: NTIS (US Sales Only), PC A05/MF A01.

In the project has been developed a graphic information system for electrical distribution networks. The system provides a real time data link with the supervisory control (SCADA) system. The network information system is a common 20 kV and 0.4 kV information system for designers, builders and operators. System includes functions for updating and producing network diagrams, maps and drawings. Load flow calculation is based on statistical load demand curves for different customer categories. The calculation provides the network operation and the distribution analysis in daily situations. In the fault calculation protection relay settings are checked. Results of the calculations are illustrated by colouring feeders and sections or by presenting load curves of the components pointed. An important basic application is the real time management of switching status of the 20 kV network in the control room. The status changes of the switchgears operated manually are interactively updated on graphic diagrams on the screen. The status changes transmitted from SCADA are updated automatically. Dynamic colouring of topographical diagrams and substation scemes is used to outline network connections e.g. feeders and earthed sections. Other operational aids are switching log, planning of switching programs, registers for priority customers and management of fault information. The link to the SCADA is one way link. The status data is transmitted spontaneously and the measuring data cyclically. Customer related data and background maps from administrative systems are transmitted in batch prosessing. VAXstations have been used as a developement environment. Operation system can be VMS or UNIX. User interface is

X-Window. Database is a common relational database, which is widely used in the company. The virtual memory concept is used to accelerate communication with the relational database.

50237 (ORNL/TM–11637) **Modeling histogram data with piecewise polynomials.** Worley, P.H. Oak Ridge National Lab., TN (USA). Aug 1990. 37p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90018037. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

As part of a research project on the performance characterization of parallel programs, piecewise polynomials are used to model histogram data that represents the processor utilization curve. In this paper an algorithm is described that generates a discontinuous piecewise polynomial model in time proportional to the amount of data.

50238 (PB–90-252727/XAB) **Controlling real-time systems with parallel processes.** Bron, C. Groningen Rijksuniversiteit (Netherlands). Computing Science Section. 1990. 23p. (CS–8918). Source: NTIS, PC A03/MF A01.

In the paper it is argued that the automatic control of industrial systems can be based on a structure of co-operating sequential processes. This form of control is obtained by means of a tight coupling between the (computer based) controlling processes (tasks), and the (physical) processes being controlled. The real-time aspects of this control merge naturally with the overall structure. A software package (ROSKIT) is described which supports this approach.

50239 (PNL-SA–18095) **Classification of acoustic emission waveforms for nondestructive evaluation using neural networks.** Barga, R.S.; Melton, R.B.; Friesel, M.A. Pacific Northwest Lab., Richland, WA (USA). Apr 1990. 13p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-9003200–1: Society of photo-optical institution engineering (SPIE) applications of neural networks, Orlando, FL (USA), 16-19 Mar 1990). Order Number DE90017239. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Neural networks were applied to the classification of two types of acoustic emission (AE) events, crack growth and fretting, from a simulated airframe joint specimen. Signals were obtained from four sensors at different locations on the test specimen. Multilayered neural networks were trained to classify the signals using the error backpropagation learning algorithm, enabling AE events arising from crack growth to be distinguished from those caused by fretting. In this paper we evaluate the neural network classification performance for sensor location dependent and sensor location independent training and testing sets. Further, we present a new training strategy which significantly reduces the time required to learn large training sets using the error backpropagation learning algorithm, and improves the generalization performance of the network. 10 refs., 6 figs., 3 tabs.

50240 (SAND–90-1729C) **SICADS: Site Independent Configurable Alarm Display System.** Ashby, M.R.; Weissman, S.J. Sandia National Labs., Albuquerque, NM (USA). [1990]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901101–5: American Nuclear Society winter meeting, Washington, DC (USA), 11-15 Nov 1990). Order Number DE90013074. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

SICADS is a generic command, control and display software package which provides the capability to generate security systems which employ different hardware and system configurations, but which are controlled by the same software. SICADS was designed to avoid the task of developing new software for each site. By reusing software, expenses are reduced and software quality is increased. Tested software can be reused without modifications. Configurations of security systems vary from site to site. In many systems, a seemingly minor change in configuration has required significant software modifications. SICADS has been designed to isolate site specific information into data files so that it can be easily tailored to fit a site's requirements without changing the software. Using SICADS, it is possible to generate systems which distribute processing and control over several computers and consoles. 1 fig.

50241 (SAND–90-2034C) **An adaptive finite element technique using element equilibrium and paving.** Blacker, T.D.; Jung, J.; Witkowski, W.R. Sandia National Labs., Albuquerque, NM (USA). [1990]. 30p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901109–10: International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers, Dallas, TX (USA), 25-30 Nov 1990). Order Number DE90015829. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper presents an adaptive finite element technique to automatically control analysis errors. This scheme uses a new error measure and the paving meshing algorithm. With this technique, a 2-D finite element problem can be adaptively meshed to produce an answer within a desired error tolerance. In this paper we describe the new error measure as well as the paving mesh generation technique. We then describe the process of controlling the mesh generation with the error measure and present several examples that demonstrate the capacity of this adaptive technique. 19 figs., 3 tabs.

50242 (UCRL–102263-Rev.2) **SISAL versus FORTRAN: A comparison using the Livermore Loops: Revision 2.** Cann, D.; Feo, J. Lawrence Livermore National Lab., CA (USA). Apr 1990. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-901121–1: Association for Computing Machinery/Institute of Electrical and Electronics Engineers supercomputing conference, New York, NY (USA), 12-16 Nov 1990). Order Number DE90010872. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The acquisition of parallel processors in the scientific community is increasing, but the difficulties of programming parallel machines persist. Two approaches have emerged: automatic parallelizing compilers for extant languages, and new languages that provide an easier-to-use and cleaner parallel programming model. Unfortunately most new languages have acquired a reputation for inefficiency because of their semantics. This paper compares the performance of SISAL, an applicative language for parallel numerical computations, and FORTRAN using the Livermore Loops. Our intent is to show that applicative programs when compiled using a set of powerful yet simple optimization techniques can achieve sequential execution speeds comparable to FORTRAN, and automatically exploit conventional shared memory multiprocessors. 25 refs., 4 figs., 1 tab.

50243 (UCRL-JC–103573) **What do you do when the network is 1 to 2 orders of magnitude faster than the backplane bus?.** Abrahams, S. Lawrence Livermore National Lab., CA (USA). Apr 1990. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-901121–2: Association for Computing Machinery/Institute of Electrical and Electronics Engineers supercomputing conference, New York, NY (USA), 12-16 Nov 1990). Order Number DE90011231. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The prototype High Performance Switching System will connect several different types of machines with widely varying clock and internal bus speeds. At one end of the range we have a CRAY YMP and a CRAY XMP whose HPPI interface will operate at the 1 gigabaud rate. At the other end there are SUN 3/260 VMEbus machines (we are connecting to these machines simply because we own so many of them). In between there are various flavors of MAC IIs. This presents a real speed matching problem. The SUN VMEbus speed is approximately I megabyte per second with bursts to 13 megabytes, the MAC II NU-BUS obtains about the same speed. Compared to the switch speed of 100 megabytes per second these guys are standing still! So what do you do when the network is 1 to 2 orders of magnitude faster than the internal bus? This paper describes the approach LLNL and Ancor Communications took in the case of the SUN VMEbus machine.

50244 (UCRL-JC–104493) **IGES efficiency evaluation.** Christensen, M.; Farrell, J.; Green, S. Lawrence Livermore National Lab., CA (USA). Jul 1990. 28p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-901179–1: CUBE: computer use by engineers symposium, Santa Fe, NM (USA), 27-30 Nov 1990). Order Number DE90015192. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report describes the Initial Graphics Exchange Specifications (IGES) Efficiency Study, a joint effort of Weapons Engineering Division (WED) and Materials Fabrication Division (MFD). The goal of the study was to quantify the impact of accurate geometry in design, manufacturing and inspection of mechanical parts. Two parts were designed, manufactured and inspected; a hemispherical and non-hemispherical part. Each part was designed in WED using CAD. Then three sources of numerical control (NC) tool paths and inspection probe paths were received in MFD: (1) an unchecked CAD/IGES database, (2) a guaranteed CAD/IGES database, (3) an electronic Hewlett-Packard Graphics Language (HPGL) file presenting the CAD drawing. 4 tabs.

50245 The single-chip FASTBUS slave interface. Nelson, R.O.; Machen, D.R.; Downing, R.W. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA)*, 37(2): 310-314 (Apr 1990). (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

This paper reports a single-chip implementation of the general-purpose FASTBUS slave interface (FSI) developed in ECL gate-array technology. The FSI will occupy on 1.6% of the available circuit board space while providing a complete 32-bit interface to the FASTBUS. All mandatory slave-interface requirements of IEEE 960 are supported, in addition to several non-mandatory requirements and the optional, extended MS code features. Geographic, logical, and broadcast addressing are implemented using on-chip registers. An optional multiple-module addressing technique is included that allows participating modules residing on a common crate or cable segment to respond as if individually addressed in sequence.

50246 Ultra-fast voltage comparators for transient waveform analysis. Smith, R.C. (Los Alamos National Lab., NM (USA)); Turko, B.T.; Kolbe, W.F. *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA)*, 37(2): 424-429 (Apr 1990). DOE Contract AC03-76SF00098 ;W-7405-ENG-36. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

The time at which an input signal crosses the reference level of a voltage comparator can be used in the analog-to-digital conversion of fast single waveform transients. In such a converter, an array of identical comparators, properly biased, provides stop inputs to a picosecond resolution multistop time digitizer. Each stop represents a point in the voltage-time reconstruction of the measured waveform. A number of state-of-the-art comparators, bipolar and GaAs, have been evaluated for this application to determine the differences in their time propagation as a function of the input signal overdrive and risetime. Normalized data is presented to assist in the correction of a digitizer's measurement errors. A picosecond time resolution measurement system used in the tests is also described.

50247 Dynamic processor self-scheduling for general parallel nested loops. Fang, Z. (Convex Computer Corp., Richardson TX (US)); Tang, P.; Yew, P.C.; Zhu, C.Q. *IEEE Transactions on Computers (Institute of Electrical and Electronics Engineers) (USA)*, 39(7): 919-929 (Jul 1990). Grant MIP-8410110.

This paper proposes a processor self-scheduling scheme for general parallel nested loops in multiprocessor systems. Parallel loops usually constitute most of the execution time in scientific application programs. In a general parallel loop structure, parallel loops, serial loops, and If-Then-Else constructs are nested in an arbitrary order, and the execution time of the loop body may vary substantially from iteration to iteration. In the proposed scheme, programs are instrumented to allow processors to schedule loop iterations among themselves dynamically at run time without the involvement of the operating system.

50248 The role of model based control in robotics. Harrigan, R.W. (Sandia National Labs., Albuquerque, NM (USA)). *IEEE Transactions on Nuclear Science (Institute of Electrical and Electronics Engineers) (USA)*, 37(3): 1426-1431 (Jun 1990). DOE Contract AC04-76DP00789. (CONF-900143–: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990).

This paper discusses the use of model based control of industrial robots. Computer models of the robots and their operating environments are complemented with environmental sensing. This allows automatic programming of robot trajectories, hybrid force/position control and computer assist during manual operation. In addition, sensors detect error situations which may require operator attention prior to continued system operation.Computer models are also used to verify the validity of sensor data before the robotic system executes operations based upon those data.

9903 Information Handling

Refer also to citation(s) 48395, 48646, 48675, 48701, 48741, 48795, 49314, 49380, 49983, 49984, 49985, 49986, 50240, 50248

50249 (ETDE/PUB–2) **International Energy: Subject Thesaurus.** Raridon, M.H. (ed.). Energy Technology Data Exchange, Oak Ridge, TN (USA). 1990. 1068p. Sponsored by Energy Technology Data Exchange. Order Number DE90008750. Source: NTIS, PC A99/MF A01 - OSTI.

The International Energy Subject Thesaurus contains the standard vocabulary to indexing terms (descriptors) developed and structured to build and maintain energy information databases. Involved in this cooperative task are (1) the technical staff of the USDOE Office of Scientific and Technical Information (OSTI) in cooperation with the member countries of the Energy Technology Data Exchange (ETDE) and (2) the International Nuclear Information System (INIS) staff representing the more than ninety countries and organizations recording and indexing information for the international nuclear information community. ETDE member countries are also members of the International Nuclear Information System (INIS). Nuclear information indexed and recorded for INIS by these ETDE member countries is also included in the ETDE Energy Data Base, and indexing terminology is therefore cooperatively standardized for use in both information systems. This structured vocabulary reflects the scope of international energy research, development, and technological programs and encompasses terminology derived not only from the basic sciences but also from the areas of energy resources, conservation, safety, environmental impact, and regulation.

50250 (IAEA-NDS–0(Rev.90/1)) **Index to the IAEA-NDS-Documentation Series.** Lemmel, H.D. International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section. Jan 1990. 16p. Order Number DE91602680. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

This index lists the current versions of the IAEA-NDS-documents which summarize contents and formats of nuclear data libraries available from the IAEA Nuclear Data Section. (author).

50251 (IAEA-NDS–7(Rev.90/1)) **Index of data libraries available on magnetic tape from the IAEA Nuclear Data Section.** Lemmel, H.D. International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section. Jan 1990. 23p. Order Number DE91602682. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

This document lists more than 80 nuclear data libraries and some atomic data libraries together with references that give more detailed information about these libraries. All data and documentation references are available upon request from the IAEA Nuclear Data Section, free of charge. (author).

50252 (IAEA-NDS–23(Rev.3)) **ENDF/B-4: General purpose file 1974. Summary of contents and documentation.** Schwerer, O. International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section. Dec 1989. 10p. Order Number DE91602681. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

This document summarizes contents and documentation of the 1974 version of the General Purpose File of the ENDF/B Library maintained by the National Nuclear Data Centre (NNDC) at the Brookhaven National Laboratory, USA. The Library contains numerical neutron reaction data for 90 isotopes or elements. The entire

Library or selective retrievals from it can be obtained on magnetic tape from the IAEA Nuclear Data Section. (author). 3 tabs.

50253 (KEK–89-26, pp. 84-99) **Data taking system for the FANCY.** Manabe, A. (Tsukuba Univ., Ibaraki (Japan). Inst. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1990. (CONF-8903226–: Symposium on data acquisition and processing for next generation experiments, Tsukuba (Japan), 9-10 Mar 1989). In *Proceedings of symposium on data acquisition and processing for next generation experiments.* Order Number DE90508151. Source: NTIS (US Sales Only), PC A11/MF A01.

This paper describes a data taking system of the FANCY spectrometer used in the experiments of πAC collaboration (E90, E132, E133, E157, E173 and E187) at the 12 GeV PS.A readout system for a jet-chamber-type cylindrical drift chamber (CDC) in the FANCY is a multiprocessor system (10 CPU) with use of VME bus (VERSA Bus) and 680x0 microprocessors for fast data handling and for effective communication with a host computer. (author).

50254 (LA-UR–90-2637) **International english.** Amador, M. Los Alamos National Lab., NM (USA). [1990]. 26p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-36. (CONF-9009154–2: IEEE international professional communication conference, London (UK), 12-14 Sep 1990). Order Number DE90016719. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper is a presentation to the International Professional Communication Conference on International English. Presidence is taken from the Royal Society of London in 1667 to purify and simplify the English language. Because English has become the most spoken language in the world, the case in herein made to make it plainer and more easily learned. Technical communications is stressed. (FSD).

50255 (PNL-SA–17925) **Managing technical information in a multi-contractor environment.** Anderson, E.N. Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 6p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-9006168–1: INFOTECH '90: DOE technical meeting, Oak Ridge, TN (USA), 20-21 Jun 1990). Order Number DE90016337. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Expanded efforts to transfer federally-funded technology and the public's growing interest in the DOE's activities present challenges to managers of technical information (TI). The multi-contractor environment of the Hanford Site further complicates the picture. In an effort to strengthen the Site's TI program, representatives of the DOE's Richland Operations Office and its four Hanford contractors formed a Hanford Technical Information Council. Other TI managers may benefit from hearing how the council is dealing with the issues before it.

Corporate Author Index

This index lists the corporate authors responsible for issuing the documents in this publication which are identified primarily by report number. The corporate names are entered in standardized forms as defined in *DOE Energy Data Base: Corporate Author Entries* (DOE/TIC-4585). Each entry under a corporate name includes the document title and citation number. Three items of information may appear in parentheses: (1) an abbreviation to identify the document type, such as a report; (2) the country of publication, also abbreviated; and (3) the language of the document if non-English (R;US;In French). Author affiliations are not listed in this index.

A

ABB Power Systems, Inc., Pittsburgh, PA (USA)
DSM [Demand-Side-Management]: Transmission and distribution impacts: Volume 2, Application on spatial frequency analysis: Final report, 15:48749 (R;US)

ACEC Research and Management Foundation, Washington, DC (USA)
State-of-the-art interior-piping-systems applications: Commercial buildings. Final report, June 1987-June 1989, 15:48792 (R;US)

Acid Deposition Research Program, Calgary, AB (Canada)
Members committee report: Critical point one, 15:49465 (R;CA)

Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France)
Calibration of photovoltaic cells and modules used for terrestrial applications, 15:48457 (R;FR;In French)
Deep geology program in France, third research phase (1985-1986), 15:48477 (R;FR;In French)
Development of an operating aid device for ground water heat pump system, 15:48768 (R;FR;In French)
Dynamic test of a 9m diameter wind turbine, 15:48480 (R;FR;In French)
Experimental study of aeraulics heating. Final Report, 15:48767 (R;FR;In French)
Field trial procedure to assess the behavior of photovoltaic modules under natural condition, 15:48458 (R;FR)
Geothermics a 1982-1985 review, 15:48476 (R;FR;In French)
Putting into service the RFO wind turbine at the CNEEL, 15:48481 (R;FR;In French)
Resistance of solar modules to environment constraints, 15:48456 (R;FR;In French)
Small hydro-electric power stations, 15:48446 (R;FR;In FR, EN)
Software to estimate the energy production of wind turbine, 15:48482 (R;FR;In French)
Solar energy photovoltaic conversion 1982-1985 research review, 15:48455 (R;FR;In French)
Study of photovoltaic sites in the Alpes-de-Haute-Provence, 15:48466 (R;FR;In French)

Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA)
Health assessment for Abex Corporation, Portsmouth, Elizabeth County, Virginia, Region 3. CERCLIS No. VAD980551683. Preliminary report, 15:49582 (R;US)
Health assessment for Elizabethtown Landfill, Elizabethtown, Lancaster County, Pennsylvania, Region 3. CERCLIS No. PAD980539712. Final report, 15:49614 (R;US)
Health assessment for Gautier Oil Co., Inc., Gautier, Mississippi, Region 4. CERCLIS No.MSD098596489. Preliminary report, 15:49534 (R;US)
Health assessment for GBF, Inc., Dump, Antioch, Contra Costa County, California, Region 9. CERCLIS No. CAD980498562. Preliminary report, 15:49620 (R;US)
Health assessment for Intersil, Inc./Siemens Components, Cupertino, Santa Clara County, California, Region 9. CERCLIS No. CAD041472341. Preliminary report, 15:49627 (R;US)
Health assessment for Kent County Landfill (Houston), Houston, Kent County, Delaware, Region 3. CERCLIS No. DED980705727. Preliminary report, 15:49535 (R;US)
Health assessment for Occidental Chemical Corporation Site, Lower Pottsgrove Township, Montgomery County, Pennsylvania, Region 3. CERCLIS No. PAD980229298. Preliminary report, 15:49623 (R;US)
Health assessment for Recticon/Allied Steel Corporation, Parkerford, Chester County, Pennsylvania, Region 3. CERCLIS No. PAD053302865. Preliminary report, 15:49533 (R;US)
Health assessment for Rose Hill Regional Landfill, South Kingstown, Rhode Island, Region 1. CERCLIS No. RID980521025. Preliminary report, 15:49622 (R;US)
Health assessment for Tex Tin Corporation, National Priorities List Site, Texas City, Texas, Region 6. CERCLIS No. TXD062113329. Preliminary report, 15:49617 (R;US)
Health assessment for Tri-City Industrial Disposal Site, Brooks, Kentucky, Region 4. CERCLIS No. KYD981028350. Preliminary report, 15:49619 (R;US)
Health assessment for Union Carbide Disposal/Red Oak Landfill Site, Red Oak, Iowa, Region 7. CERCLIS No. IAD980643509. Preliminary report, 15:49539 (R;US)
Health assessment for Waste Engineering, Inc., Sanitary Landfill, Andover, Minnesota, Region 5. CERCLIS No. NMD9806091192 (amended). Final report, 15:49632 (R;US)

Air Force Environmental Technical Applications Center, Scott AFB, IL (USA)
Conditional climatology of Ap: The relationship between solar flares and geomagnetic storms, 15:49851 (R;US)

Air Force Geophysics Lab., Hanscom AFB, MA (USA)
Pi 2 pulsations and the substorm current wedge: Low-latitude polarization, 15:49857 (R;US)
Simultaneous relativistic-electron and auroral-particle access to the polar caps during interplanetary magnetic field Bz northward: A scenario for an open-field line source of auroral particles, 15:49852 (R;US)

Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)
Analysis of the morality of intention in nuclear deterrence, with special reference to final retaliation. Doctoral thesis, 15:48846 (R;US)
Development, application and assessment of a taxonomy for characterizing international environmental problems. Master's thesis, 15:48735 (R;US)

Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering
Thermal analysis of heat-pipe radiators with a rectangular groove wick structure. Master's thesis, 15:49159 (R;US)

Air Force Wright Research and Development Center, Wright-Patterson AFB, OH (USA)
High-temperature superconductivity applications for electronic warfare and microwave systems. Final report, March 1988-March 1990, 15:49390 (R;US)

Air Weather Service, Scott AFB, IL (USA)
Calculating toxic corridors. Revision. Technical report, 15:49415 (R;US)

Alabama Univ., Huntsville, AL (USA). Kenneth E. Johnson Research Center
A microprocessor based charge control system for the simultaneous charging of several batteries with one charge controller: Final report for 1989, 15:48839 (R;US)

Alaska Univ., Anchorage, AK (USA). Inst. of Social and Economic Research
A handbook for management of oil and gas activities on lands in Alaska: Petroleum industry practices, environmental impacts and stipulations, 15:48149 (R;US)

Albert Einstein Medical Center, Philadelphia, PA (USA). Radiation Research Lab.
Mechanism of action of radiation-protective agents: In-vivo distribution and metabolism of cysteamine-S-phosphate (MEAP). Annual report, 1 July 1968-30 June 1969, 15:49709 (R;US)

Alberta Energy and Natural Resources, Edmonton, AB (Canada). Scientific and Engineering Services and Research Div.
Methods for producing liquid hydrocarbons from coal, 15:48080 (R;CA)

Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee
Alberta reclamation research annual report, 1987, 15:48734 (R;CA)
Plains hydrology and reclamation project: Spoil ground-water chemistry and its impacts on surface water, 15:48098 (R;CA)
Proceedings of the conference Reclamation, a global perspective: Volume 1, 15:49413 (R;CA)
Proceedings of the conference Reclamation, a global perspective: Volume 2, 15:49414 (R;CA)

Alberta Public Safety Services, Edmonton, AB (Canada)
Beryllium disease: A summary of the occupational health concern, 15:49718 (R;CA)

Alberta Research Council, Edmonton, AB (Canada)
Towards a strategy for adapting to climate change in Alberta, 15:49455 (R;CA)

Alberta Research Council, Edmonton, AB (Canada). Oil Sands Hydrocarbon Recovery
A study of asphaltene flocculation in heavy oil and asphalt solutions: Final report, 15:48174 (R;CA)

Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div.
Ion chromatography in the manufacture of multilayer circuit boards, 15:49209 (R;US)
Software quality assurance handbook, 15:50222 (R;US)

American Inst. of Physics, New York, NY (USA)
Advanced accelerator concepts, 15:49226 (B;US)
The physics of electronic and atomic collisions, 15:49868 (B;US)

American Meteorological Society, Boston, MA (USA)
Atmospheric processes over complex terrain: Volume 23, No. 45, 15:49458 (R;US)

Ames Lab., IA (USA)
μ^+SR studies on $Sr_2CuO_2Cl_2$, La_2CuO_4, and Nd_2CuO_4: 2-d magnetism, local fields and muon sites, 15:48923 (R;US)
A study of the thermoelectric properties of Ca, Sr and Hg substituted lanthanum sulfides, 15:48956 (R;US)
A theoretical investigation on structural, vibrational, and electronic properties of amorphous silicon, 15:48879 (R;US)
Analysis of deformation characteristics of a heavily deformed Cu-20%Nb composite, 15:48880 (R;US)
Characterization of short fatigue cracks at notches in SiC particulate aluminum composite, 15:48957 (R;US)
Characterizing closure asperities by ultrasonic measurements, 15:48919 (R;US)
Coal handleability: Addressing the concerns of the electric utility industry, 15:48104 (R;US)
Deducing mechanical properties due to interfaces from their acoustical response, 15:48877 (R;US)
Effects of design details on the capacity of steel containment buildings, 15:48654 (R;US)
Elementary inversion, energy velocity, and a generalized Sommerfeld theorem, 15:50097 (R;US)
Experimental studies of the production of lightweight aggregate from fly ash/coal cleaning refuse mixtures, 15:48094 (R;US)
Insights on pyritic sulfur in coal from image analysis, 15:48089 (R;US)
Load turndown in a two-bed fluidized combustor, 15:48116 (R;US)
Measurement of α_s from energy-energy correlations in e^+e^- annihilation at 29 GeV, 15:49912 (R;US)
Microcharacterization of coal components for beneficiation: Fossil energy quarterly report, April 1, 1989–June 30, 1989, 15:48087 (R;US)
Microfilamentary $Bi_2Sr_2Ca_1Cu_2O_8$ fibers, 15:48922 (R;US)
Modern chemical analysis of nuclear materials, 15:48995 (R;US)
Novel measurements of nuclear spin cross-relaxation in metal hydrides, 15:50076 (R;US)
Nuclear magnetic resonance survey of hydrogen motion and electronic structure in α-phase (Nb-Mo)-H alloys, 15:50075 (R;US)
Oxidation of chromium(II) by hydroxylamine-O-sulfonic acid, 15:49034 (R;US)
Physical metallurgy and magnetic behavior of Cd stabilized bcc (beta)Gd alloys, 15:48881 (R;US)
Processing of $YBA_2Cu_3O_7$ tapes from a molten salt precursor, 15:48924 (R;US)
Production techniques for discontinuous filament A-15 superconductor wire, 15:48876 (R;US)
Structure of Au and Pt films on Pd(110): Deposition temperature and coverage dependent (1 times 2) and (1 times 3) reconstructions, 15:48878 (R;US)
The upper critical field of $HoBa_2Cu_3O_{7-\delta}$ for H || c, 15:48918 (R;US)
Thermodynamic critical field of $Y_1Ba_2Cu_3O_7$, 15:48921 (R;US)

AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij
Determination of number of interacting nucleons in the nuclear pionization model, 15:50047 (R;SU;In Russian)
Observation of the Dirac magnetic charges by virtue of a diffusion chamber, 15:49909 (R;SU)
On the strange particle production in the nuclear pionization model, 15:50043 (R;SU;In Russian)
Possible change of growth regime for the total cross section of hadron processes at E_0 >or approx. 10^{15} eV, 15:49956 (R;SU;In Russian)
Proceedings of the seminar of young scientists HEPI AN Kaz SSR. Part 1: 1. High energy physics and computer technique, 15:49901 (R;SU;In Russian)
Proceedings of the seminar of young scientists HEPI AN Kaz SSR. Part 2: 2. Solid state physics and mass transfer simulation, 15:50080 (R;SU;In Russian)
Study of multiparticle correlations in 200-400 GeV range, 15:49992 (R;SU;In Russian)

AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Yadernoj Fiziki
Cross sections of scattering of ^3He ions and α-particles with 12-20 MeV/nucleon energy on the light nuclei, 15:49989 (R;SU;In Russian)
Detection and experimental investigation of α-particle Wolf-Bragg scattering on quasicrystalline atomic nuclei, 15:49990 (R;SU;In Russian)

AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki
Information plates TP, δT and T2A for the KLYuKVA data collection system, 15:49207 (R;SU;In Russian)
Interface for the local net B0612, 15:49208 (R;SU;In Russian)
On the electronic structure of high temperature superconductors: Nonalloyed CuOsub 2 plane, 15:50077 (R;SU;In Russian)
Software for the ODRA and ODRENOK computers; programs for text file processing, 15:50220 (R;SU;In Russian)
Total emission current in one-chamber electron-optical converters, 15:49384 (R;SU;In Russian)

AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst.
Analytical representation of the geometry of helical windings for plasma devices, 15:50179 (R;UA;In Russian)
Excitation of regular oscillations and acceleration of charged particles by electron beam in a non-uniform plasma resonator, 15:50159 (R;UA;In Russian)
Forced scattering of a non-ordinary electromagnetic wave by an electron beam in a plasma in magnetic field, 15:50157 (R;UA;In Russian)
Influence of the Ore slot on the positron energy distribution function, 15:49879 (R;UA;In Russian)
Instaliation of disruption instability in the Uragan-2 large-shear stellarator, 15:50160 (R;UA;In Russian)
Integral equations for elastic wave scattering on non-uniformities in anisotropic media, 15:49235 (R;UA;In Russian)

Island structure growth and continuous film production criteria. 1. Weak atom sources, 15:48884 (R;UA;In Russian)
Island structure growth and continuous film production criteria. 2. Strong atom sources, 15:48885 (R;UA;In Russian)
On the diffusion in metallic glasses near the vitrification temperature, 15:48959 (R;UA;In Russian)
Some dynamical properties of the linear three-particle chain, 15:50102 (R;UA;In Russian)
Study on the atom beams and plasma production at the materials evaporation by laser radiation, 15:50158 (R;UA;In Russian)
Study on the fracturing of cermets in the tungsten monocarbide-cobalt system during microimpact loading, 15:48926 (R;UA;In Russian)

AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki
A three-dimensional model of separable potential interaction at high energies, 15:49943 (R;UA;In Russian)
An off-energy description of hadron-hadron interaction within the P-matrix approach, 15:49945 (R;UA)
Bose-condensation in limited two-dimensional systems and the critical temperatures of superconducting ceramics, 15:48925 (R;UA;In Russian)
Bound states and the formalism of composite operators in gauge theories, 15:49967 (R;UA;In Russian)
Comparison of theoretical and phenomenological phase shifts for $^3He(\alpha,\alpha)^3He$ scattering at ^7Be excitation range between 25 and 42 MeV, 15:50034 (R;UA)
Electromagnetic wave incoherent reflection by a plasma layer, 15:50153 (R;UA;In Russian)
Equilibrium distributions in plasma-molecular systems with non-plane boundaries, 15:50154 (R;UA;In Russian)
Formation and dynamics of shell structures in the astrophysical systems under the accretion of gas on the source of wind activity, 15:49813 (R;UA;In Russian)
Geometrical and dynamical characteristics of the Earth, the Moon and Terrestrial planets. Part 1: 1.Topographic surfaces and Gravitational fields, 15:49812 (R;UA;In Russian)
Light quark mass relations from finite energy sum rules, 15:49947 (R;UA)
Method of exact solutions in investigating the electromagnetic field influence on different quantum processes, 15:49944 (R;UA;In Russian)
Mutual coherent properties of the images of the quasar microlensed by star mass, 15:49816 (R;UA)
On zero modes of the Dirac operator on noncompact two-dimensional surface in magnetic field, 15:49968 (R;UA;In Russian)
Parametric instabilities of electromagnetic waves in layer of plasma-molecular medium, 15:50152 (R;UA;In Russian)
Saturation of hadron process at high energies: alternative approaches to its realization, 15:49948 (R;UA)
Seeley-Gilkey coefficients for the fourth-order operators on a Riemannian manifold, 15:49969 (R;UA)
Statistical characteristics of turbulence in giant molecular clouds. Part 1: 1. Spectra in inertial range, 15:49814 (R;UA)
Statistical characteristics of turbulence in giant molecular clouds. Part 2: 2. Clump properties, 15:49815 (R;UA)
Study of the effects in three-nucleon systems due to the violation of nuclear forces charge independence, 15:49946 (R;UA)
The spectra of spontaneous emission from inhomogeneous plasma half-space, 15:50151 (R;UA;In Russian)
Threshold anomaly in doublet nd-scattering, 15:50033 (R;UA)

Angewandte Physik Consulting GmbH (APC), Stuttgart (Germany, F.R.)
Investigations of water entrainment during hypothetical reactor accidents. Final report, 15:48637 (R;DE;In German)

Applied Research Corp., Landover, MD (USA)
Computer-oriented, multichannel, direct-current, superconducting quantum interference device. Final report, 30 September 1988-31 March 1989, 15:49201 (R;US)

Argonne National Lab., Idaho Falls, ID (USA)
Neutron beam characterization at the Neutron Radiography Reactor (NRAD), 15:48402 (R;US)
Reprocessing input data validation, 15:48388 (R;US)
The Neutron Radiography Reactor (NRAD), 15:48620 (R;US)

Argonne National Lab., IL (USA)
A very wide bandwidth Faraday cup suitable for measuring gigahertz structure on ion beams with velocities down to $\beta < 0.01$, 15:49241 (R;US)
An integrated acid precipitation policy and energy market model, 15:48097 (R;US)
Chemical identification of icosahedral structure for cobalt and nickel clusters, 15:48865 (R;US)
Computation of standard deviations in eigenvalue calculations, 15:50052 (R;US)
Computer-controlled ion beam deposition systems for high T_c superconductor and other multi-component oxide thin films and layered structures, 15:48911 (R;US)
Conversational Monitor System (CMS) at Argonne National Laboratory (ANL): Revision 2, 15:50212 (R;US)
CORQUENCH: A model for gas sparging-enhanced melt-water, film boiling heat transfer, 15:48644 (R;US)
Corrosion behavior of materials in FBC [fluidized-bed combustion] environments, 15:48105 (R;US)
Design and testing of a high temperature superconducting current lead, 15:49205 (R;US)
Dry FGD [flue-gas desulfurization] at Argonne National Laboratory, 15:48500 (R;US)
ECR [electron cyclotron resonance] ion sources and applications with heavy-ion linacs, 15:49240 (R;US)
Effects of jet port arrangement on three-dimensional non-reacting jet -gas mixing in an MHD second stage combustor, 15:48106 (R;US)
Environmental impact assessment for a radioactive waste facility: A case study, 15:48259 (R;US)
Epitaxial TiO_2 and VO_2 films prepared by MOCVD [metal-organic chemical vapor deposition], 15:48915 (R;US)
Estimating the effect of generating unit age on EFOR [equivalent forced outage rate] and EAF [equivalent availability factor] for coal-fired steam units operating between 1964 and 1981, 15:48485 (R;US)
Excess oxygen defects in layered cuprates, 15:48913 (R;US)
Fast reactor safety testing in Transient Reactor Test (TREAT) in the 1980s, 15:48640 (R;US)
Hazardous waste characterization of solid wastes generated from clean coal technologies, 15:48091 (R;US)
Heavy ion transfer reactions: Status and prospects, 15:50024 (R;US)
Kinetics of recrystallization and fission-gas induced swelling in high burnup UO_2 and U_3Si_2 nuclear fuels, 15:48218 (R;US)
Laser Raman spectroscopy "for in-situ" analysis of corrosion films on metals, 15:48866 (R;US)
Liquid alloys with strong interactions, 15:48868 (R;US)
Magnetic properties of ultrathin epitaxial films of iron, 15:48861 (R;US)
Mechanistic interpretation of an observed rate dependence of low temperature swelling of irradiated uranium silicide dispersion fuels, 15:48217 (R;US)
Microscopic integral cross section measurements in the Be(d,n) neutron spectrum for applications in neutron dosimetry, radiation damage and the production of long-lived radionuclides, 15:49980 (R;US)
Modeled sulfur deposition trends since 1990 in North America, 15:49456 (R;US)
Molecular-dynamics study of grain-boundary migration in metals, 15:48860 (R;US)
Nuclear Technology Programs semiannual progress report, October 1987–March 1988, 15:48729 (R;US)
Nucleon parton distributions and nuclear structure, 15:49979 (R;US)
Open-gradient magnetic separation for physical coal cleaning: Results for Pittsburgh No. 8 and Upper Freeport coals, 15:48071 (R;US)
Parallelization of a radiation transport simulation code on the BBN TC2000™ parallel computer, 15:49285 (R;US)
Performance evaluation of a groundwater and soil gas remedial action, 15:49566 (R;US)

Population of superdeformed bands, the competition with fission, and the barrier between normal and superdeformed states, 15:50011 (R;US)
Proceedings of the third International Atomic Energy Agency specialist's meeting on subcritical crack growth: Opening session and Technical session 1, 15:48537 (R;US)
Proceedings of the third International Atomic Energy Agency specialists' meeting on subcritical crack growth: Technical sessions 2, 3, and 4 and Recommendations and conclusions Session 5, 15:48538 (R;US)
Realizations of polarized targets in storage rings, 15:49277 (R;US)
Relationship of microstructure and tensile properties for neutron-irradiated vanadium alloys, 15:50167 (R;US)
Reuse of incinerated soil residues in land reclamation, 15:49567 (R;US)
Shipping, use, and disposal/recycle considerations for sodium/beta batteries in electric vehicle (EV) applications, 15:48838 (R;US)
Some thoughts on opportunities with reactions using radioactive beams, 15:50023 (R;US)
Strategies for utilizing ferrous*EDTA chelate as an additive in combined SO_2/NO_x aqueous scrubbing systems, 15:48499 (R;US)
Structure of molten salts, 15:48949 (R;US)
Summary of the NAPAP state of science report on deposition monitoring in North America, 1979–1987, 15:49457 (R;US)
Superconducting and structural properties of the $(Ba_{0.6}K_{0.4})(Bi_{1-y}Sb_y)O_3$ system, 15:48910 (R;US)
Superdeformation in the mercury region, 15:50022 (R;US)
SWAAM-code development and verification and application to steam generator designs, 15:48581 (R;US)
Symbolic manipulation software and the study of differential equations, 15:50215 (R;US)
The chemistry of plutonium(VI) in aqueous carbonate solutions, 15:49033 (R;US)
The effect of defect clusters formed in cascades on the sink strength in irradiated materials, 15:48863 (R;US)
The interaction of point defects with line dislocations in HVEM [high voltage electron microscope] irradiated Fe-Ni-Cr alloys, 15:48862 (R;US)
The MELTSPREAD-1 computer code for the analysis of transient spreading in containments, 15:48643 (R;US)
The ORR Whole-Core LEU Fuel Demonstration: Final report, 15:48609 (R;US)
The transuranium elements: Members of the 5f series, 15:49869 (R;US)
The TRansUranium EXtraction (TRUEX) process: A vital tool for disposal of US defense nuclear waste, 15:48257 (R;US)
Thermal-hydraulic impact of failure of highly irradiated fuel pins on LMR passive safety, 15:48641 (R;US)
Three-dimensional computer simulation of non-reacting jet-gas flow mixing in an MHD second stage combustor, 15:48107 (R;US)
Unsteady fluid forces and fluidelastic vibration of a group of circular cylinders, 15:49177 (R;US)
Waste management aspects of the Formerly Utilized Sites Remedial Action Program, 15:48258 (R;US)
$YBa_2Cu_3O_x$ superconductor coil: Processing and properties, 15:48914 (R;US)
$YBa_2Cu_3O_x$ composites with improved toughness and strength, 15:48916 (R;US)

Argonne National Lab., IL (USA). Advanced Photon Source Div.
Proceedings of the third users meeting for the Advanced Photon Source, 15:49224 (R;US)
Synchrotron x-ray sources and new opportunities in the soil and environmental sciences: Workshop report, 15:49565 (R;US)

Argonne National Lab., IL (USA). Environmental Assessment and Information Sciences Div.
Identification and estimation of socioeconomic impacts resulting from perceived risks and changing images: An annotated bibliography, 15:48255 (R;US)

Arizona Univ., Tucson, AZ (USA)
Axions and SN 1987A: Axion trapping, 15:49824 (R;US)

Arizona Univ., Tucson, AZ (USA). Dept. of Chemical Engineering
Mechanisms of surface enrichment and adhesion of coal combustion particulates: Sixth and seventh quarterly reports, December 16, 1987–June 15, 1988, 15:48112 (R;US)
Mechanisms of surface enrichment and adhesion of coal combustion particulates: Eighth and ninth quarterly reports, June 16, 1988–December 15, 1988, 15:48113 (R;US)

Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab.
Laser-induced IR fluorescence spectra of simulant chemical threat agent and exhaust vapors. Technical report, 15:49408 (R;US)

Army Concepts Analysis Agency, Bethesda, MD (USA)
Nuclear-effects model embedded stochastically in simulation (NEMESIS) summary report. Technical paper, 15:49404 (R;US)

Army Engineer Waterways Experiment Station, Vicksburg, MS (USA)
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): Striped bass, 15:49588 (R;US)

Army War Coll., Carlisle Barracks, PA (USA)
Chemical weapons proliferation in the Middle East: What is the proper response. Study project, 15:48849 (R;US)
Intelligence support to arms control. Study project, 15:48850 (R;US)
Strategic Defense Initiative three reasons to stay the course. Individual study project, 15:49407 (R;US)

Associated Nuclear Services, Epsom (UK)
Assessment of the agricultural implications of land burial of radioactive wastes: soil processes, 15:48256 (R;GB)
Incorporation of experimental data, review and documentation of the SPADE database, 15:49711 (R;GB)

Associated Nuclear Services, London (UK)
VANDAL technical overview: VANDAL version 1.1, 15:48267 (R;GB)

Association Euratom-CEA, Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherches sur la Fusion Controlee
Diagnosis of superthermal electrons using cyclotron radiation, 15:50121 (R;FR)

Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.
The effect of dissolved zinc on the transport of corrosion products in PWRs: Final report, 15:48544 (R;US)

Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia)
Environmental survey at Lucas Heights Research Laboratories, 1987, 15:48372 (R;AU)

B

Babcock and Wilcox Canada Ltd., Toronto, ON (Canada)
Weld process development for fabrication of heavy wall pressure vessel: Part 3, 15:48858 (R;CA)

Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div.
Multiloop Integral System Test (MIST): Final report: MIST phase 4 tests: Volume 11, 15:48665 (R;US)
Multiloop Integral System Test (MIST): Final report: MIST Phase 4 tests, 15:48666 (R;US)

Babcock and Wilcox Co., Barberton, OH (USA)
Limb demonstration project extension: Quarterly report No. 12, February, March, and April, 1990, 15:48502 (R;US)

Babcock and Wilcox Co., Lynchburg, VA (USA). Nuclear Power Div.
Multiloop Integral System Test (MIST): Final report: MIST phase 4 tests: Volume 11, 15:48665 (R;US)
Multiloop Integral System Test (MIST): Final report: MIST Phase 4 tests, 15:48666 (R;US)

Babcock and Wilcox Owners Group, Lynchburg, VA (USA)
Multiloop Integral System Test (MIST): Final report: MIST phase 4 tests: Volume 11, 15:48665 (R;US)
Multiloop Integral System Test (MIST): Final report: MIST Phase 4 tests, 15:48666 (R;US)

Battelle Columbus Div., OH (USA)
Radionuclide release calculations for selected severe accident scenarios: Supplemental calculations, 15:48663 (R;US)

Bhabha Atomic Research Centre, Bombay (India)
A study of radon variation in dwelling during 1988, 15:50062 (R;IN)

Determination of non-metallic elements in actinide complexes by oxygen flask combustion (OFC): chlorine and fluorine, 15:48989 (R;IN)
Manifolds, tensors and differential forms: some applications in physics, 15:50090 (R;IN)
Particle simulation of a two-dimensional electrostatic plasma, 15:50109 (R;IN)
Pre-operational external radiation monitoring in NAPP environs using TLDs (Jan 1987 - Mar 1989), 15:50061 (R;IN)
Purification of degraded TBP solvent using macroreticular anion exchange resin, 15:48222 (R;IN)
Radiochemistry Division: annual progress report: 1987, 15:49147 (R;IN)
Separation and purification of uranium product from thorium in thorex process by precipitation technique, 15:48223 (R;IN)

Biomass Energy Inst., Inc., Winnipeg, MB (Canada)
Let's clear the air, 15:48842 (R;CA)

Bishop (J.V.), Midland, MI (USA)
Solidification in cement of ion-exchange resins from LOMI [Low Oxidation State Metal Ion] decontamination: Final report, 15:48269 (R;US)

Bochum Univ. (Germany, F.R.). Fakultaet fuer Maschinenbau
A computer program system for the analysis of 3-d steady flows in turbomachinery components, 15:49178 (R;DE;In German)

Bordeaux-1 Univ., 33 (France)
Convergence of numerical schemes suitable for two dimensional nonlinear convection: application to the coupling of modes in a plasma, 15:50092 (R;FR;In French)

Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires
Beta decay of ^{22}O, 15:50002 (R;FR)
Search for β -^{2} He, β - p α and β - ^{3}p in the proton-rich nucleus ^{31}Ar, 15:50003 (R;FR)

Boston Univ., MA (USA)
Neutral and ion composition changes in the F Region over Millstone Hill during the equinox transition study, 15:49856 (R;US)
Thermosphere-ionosphere coupling: An experiment in interactive modeling, 15:49850 (R;US)

British Columbia Univ., Vancouver, BC (Canada). TRIUMF Facility
Capture and transfer of pions in hydrogenous materials, 15:49894 (R;CA)
Experimental area design for operation at high intensities, 15:49265 (R;CA)
Superallowed Fermi beta-decay: Applications, 15:50051 (R;CA)

British Gas PLC, London (UK)
Absorption heat pumps: Proceedings of a workshop, 15:48807 (R;LU)

Brookhaven National Lab., Upton, NY (USA)
Axial asymmetry and the IBM, 15:50018 (R;US)
Bias in peak clad temperature predictions due to uncertainties in modeling of ECC bypass and dissolved non-condensable gas phenomena, 15:48664 (R;US)
Bounding core temperature transients for severe and rapid water ingress scenarios in modular high temperature gas-cooled reactors, 15:48638 (R;US)
Determination of hydrogen (deuterium) density profiles in thin metal films and multilayers by neutron reflection, 15:48857 (R;US)
Effects of the residual proton-neutron interaction in the development of collectivity in nuclei, 15:50020 (R;US)
Empirical proton-neutron interaction energies and nuclear structure, 15:50021 (R;US)
Operational status of the Brookhaven National Laboratory Accelerator Test Facility, 15:49225 (R;US)
Proceedings of the workshop on heavy ion physics at the Alternating Gradient Synchrotron (AGS), 15:49978 (R;US)
Resummation and the gluon damping rate in hot QCD, 15:49918 (R;US)
SSC detector R&D at Brookhaven National Laboratory (BNL): April 1990 Status report, 15:49283 (R;US)
Superconducting x-ray lithography source Phase 1 (XLS) safety analysis report, 15:49276 (R;US)
The BNL 200 MeV H^- linac: Performance and upgrades, 15:49239 (R;US)
The Brookhaven Superconducting X-Ray Lithography Source (SXLS), 15:49275 (R;US)
The new conceptual design of snakes and spin rotators in RHIC, 15:49230 (R;US)
The proton-neutron residual interaction in nuclear structure, 15:50019 (R;US)

Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)
Investigations of water entrainment during hypothetical reactor accidents. Final report, 15:48637 (R;DE;In German)
Retention capacity of rock salt. Final report, 15:48289 (R;DE;In German)

Bureau de Recherches Geologiques et Minieres (BRGM), 75 - Paris (France)
Deep geology program in France, third research phase (1985-1986), 15:48477 (R;FR;In French)

C

Calgary Univ., AB (Canada). Faculty of Continuing Education
Challenges and innovations 1990. Seventh annual heavy oil and oil sands technical symposium, 15:48192 (R;CA)

California Inst. of Tech., Pasadena, CA (USA). Dept. of Chemistry
Analysis of the published calorimetric evidence for electrochemical fusion of deuterium in palladium. Technical report, 15:50108 (R;US)
Efficient photovoltaic devices for InP semiconductor/liquid junctions. Technical report, 15:48454 (R;US)

California Univ., Berkeley, CA (USA). Computer Science Div.
Language support for parallel computation. Final report, September 1988-September 1989, 15:50211 (R;US)

California Univ., Irvine, CA (USA). Dept. of Community and Environmental Medicine
Acid air pollutant mixtures: Respiratory system responses and effects of exercise, 15:49720 (R;US)
Inhalation toxicology of combined acid and soot particles. Final report, 15:49719 (R;US)

California Univ., Santa Cruz, CA (USA). Inst. of Marine Sciences
Toxicology of oil-spill cleanup agents. Final report, 15:48161 (R;US)

Cambridge Univ. (UK)
The combustion of liquid fuels, 15:48176 (R;GB)

Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada)
Geotechnical study of rock-mass classification parameters for Sydney coal field, Nova Scotia, 15:48100 (R;CA)
Pressure history of a gas pipeline, 15:48189 (R;CA)
Study of asphaltene flocculation in heavy oil and asphalt solutions, 15:48173 (R;CA)
Tracer gas used for the mine-fire simulations. Report No. CRL 89-87(TR), 15:48101 (R;CA)

Canada Mortgage and Housing Corp., Ottawa, ON (Canada)
Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 1: Final report, 15:48774 (R;CA)
Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 2: Final report, 15:48775 (R;CA)
Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 3: Final report, 15:48776 (R;CA)
Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 4: Final report, 15:48777 (R;CA)
Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 5: Final report, 15:48778 (R;CA)

Canadian Centre for Occupational Health and Safety, Hamilton, ON (Canada)
Health effects of ionizing radiation, 15:49715 (R;CA)
Radiofrequency radiation in the workplace, 15:49728 (R;CA)

Canadian Earth Energy Association, Dunrobin, ON (Canada)
Engineering manual for the design and installation of ground and water source heat pump systems: Volume 1, 15:48769 (R;CA)
Installer's manual for the design and installation of ground and water source heat pump systems: Volume 2, 15:48770 (R;CA)

Canadian Energy Research Inst., Calgary, AB (Canada)
World oil market projections, 1990-2005, 15:48139 (R;CA)

World oil market projections, 1990-2005. Study No. 34, 15:48141 (R;CA)

Canadian Geotechnical Society, Waterloo, ON (Canada)
Materials: From theory to practice: Proceedings, 15:49744 (R;CA)

Canadian Industry Program for Energy Conservation, Ottawa, ON (Canada)
Energy accounting manual, 15:48804 (R;CA)

Canadian Petroleum Association, Calgary, AB (Canada)
Oil-spill preparedness in the upstream petroleum industry, 15:48152 (R;CA)

Canadian Petroleum Association, Calgary, AB (Canada). Pipeline Div.
Oil pipeline performance review, 1986, 15:48169 (R;CA)

Canadian Renewable Fuels Association (Canada)
Let's clear the air, 15:48842 (R;CA)

Canadian Society for Civil Engineering, Montreal, PQ (Canada)
Eighth Canadian hydrotechnical conference: Proceedings, 15:48443 (R;CA)

Canadian Wildlife Service, Ottawa, ON (Canada)
Environmental data bases for State of the Environment reporting: Conservation and Protection Headquarters. Technical Report Series No. 9, 15:48704 (R;CA)
Organizational and spatial frameworks for state of the environment reporting, 15:48703 (R;CA)

CAP Scientific Ltd., London (UK)
VANDAL technical overview: VANDAL version 1.1, 15:48267 (R;GB)

Carolina Power and Light Co., Raleigh, NC (USA)
NUHOMS modular spent-fuel storage system: Design, licensing and construction, 15:48233 (R;US)

CDM Federal Programs Corp., Fairfax, VA (USA)
Testing of indoor radon-reduction techniques in 19 Maryland houses. Final report, January 1987-June 1989, 15:49531 (R;US)

CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)
Interstellar gas cycling powered by star formation, 15:49747 (R;FR)

CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)
Classical treatment of the Compton collision in general relativity, 15:49923 (R;FR)
Evidence of Rayleigh-Taylor instabilities in tri-layer targets, 15:50166 (R;FR)
Satellite lines of neon-like resonance lines for 17<Z<48, 15:50110 (R;FR)
Supersonic jets of cylindrical metallic plasma shells as imploding loads in high-power dense Z-pinch, 15:50111 (R;FR)

CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete
Analysis of reactivity accidents in PWR'S, 15:48541 (R;FR)
Bibliographic study specifying the limits of fire risk presented by uranium dioxide powder, 15:48375 (R;FR;In French)
Dispositions taken in France to limit gaseous releases from PWR power plants in abnormal operating conditions, 15:48540 (R;FR)
Nuclear safety in France, 15:48542 (R;FR)
Safety problems related to the use of MOX assemblies in PWRS, 15:48543 (R;FR)
The lessons drawn from accident simulation, consequences for the operation of the Crisis Technical Center of the Nuclear Safety and Protection Institut, 15:48639 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Chimie Appliquee et d'Etudes Analytiques
Compatibility of 316L stainless steel with the liquid alloy Pb17Li, 15:48859 (R;FR)
Laser spectroscopy in a laser-produced plasma at atmospheric pressure: comparison between A.E.S., L.I.F., and L.E.I./R.I.S. for the analysis of solid samples, 15:48990 (R;FR)

CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)
Determination of iron 55 in nuclear wastes and effluents, 15:48991 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Metallurgie
Study of radiation effects on zircaloy 4 microstructure (Impact on susceptibility to fuel pellet-cladding interaction in PWR), 15:48873 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale
Study of the linear momentum transfer distribution in the ^{40} Ar + ^{12}C system at 27, 32, 36, 40, 44 and 60 MeV/A, 15:49998 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques
A 600 m^3 stratified thermal storage using sensible heat on the saclay nuclear research site (France), 15:48687 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire
Charged pion production in nucleus-nucleus collisions at E/A between 400 and 800 mev, 15:50007 (R;FR;In French)
Generalized radiative corrections for hadronic targets, 15:49922 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Fondamentale (IRF)
The transverse displacement in a circular accelerator disturbs the hexapolar non-linearities. Application to the dynamical aperture problem, 15:49232 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)
Proposal of a crossed Bonse-Hart type camera at E.S.R.F. for very high resolution X-Ray diffraction and very low angle scattering, 15:49284 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique du Solide et de Resonance Magnetique
Low temperature susceptibility of large molar volume bcc solid ^{3}He, 15:49867 (R;FR)
Vacancies in BCC solid ^{3}He, 15:49866 (R;FR)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Moyenne Energie
Charged pion production in nucleus-nucleus collisions AT E/A between 400 and 800 MeV, 15:49982 (R;FR;In French)
Deuteron A(Q^2) structure function and the neutron electric form factor, 15:49904 (R;FR)
Hyperdeformed pear-shaped nuclei, 15:50015 (R;FR)
Pion electroproduction near threshold on protons: how reaching the axial form factor of nucleon. Preparatory study of the experiment and pion spectrometer realization, 15:49906 (R;FR;In French)
Production of light mesons in P + D reactions, 15:49903 (R;FR)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique
Effective methods in QCD and the phenomenology of hadrons, 15:49920 (R;FR)
Notes on some algebraic structures common to integrable lattice systems and conformal field theories, 15:49963 (R;FR)
Shape isomers at no spin, 15:50013 (R;FR)
Strange goings-on in the proton: a case for sheshire cat, 15:49921 (R;FR)

Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan)
Biological effects of combined exposure to coal fly ash and nitrogen dioxide. 3.: Morphological changes in respiratory organs of golden hamster, 15:48122 (R;JP;In Japanese)
Bioprocessing of coal. 1.: Microorganisms for coal processing, 15:48074 (R;JP;In Japanese)
Control of microbiofouling using bacteriophage. 2.: Detection of phages and fundamental study of their lytie effect on fouling bacteria, 15:48487 (R;JP;In Japanese)
Current status of forest decline and its research activities in Europe, 15:48702 (R;JP;In Japanese)
Development of buried cable location survey system by underground rader for power distribution cables under pavements, 15:48673 (R;JP;In Japanese)

Development of water purification technologies for intensive fish culture. 2.: Factors affecting nitrification in marine biological filter system, 15:49590 (R;JP;In Japanese)
Development of water purification technologies for intensive fish culture. 3.: Selection of marine denitrifying bacteria by their denitrification pattern, 15:49591 (R;JP;In Japanese)

Central Research Inst. of Electric Power Industry, Tokyo (Japan)
Survey of utility real-time pricing programs in the U.S, 15:48683 (R;JP;In Japanese)
Technical assessment and economic study of compressed air energy storage in Japan, 15:48685 (R;JP;In Japanese)

Centre National d'Etudes Spatiales (CNES), 31 - Toulouse (France)
Calibration of photovoltaic cells and modules used for terrestrial applications, 15:48457 (R;FR;In French)

Centre National de la Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matiernes Premieres (PIRSEM)
Geothermics a 1982-1985 review, 15:48476 (R;FR;In French)
High performance electrochemical generators, 15:48764 (R;FR;In French)
Solar energy photovoltaic conversion 1982-1985 research review, 15:48455 (R;FR;In French)

Centre National de la Recherche Scientifique, 91 - Orsay (France). Lab. d'Informatique pour la Mecanique et les Sciences de l'Ingenieur
Dynamic study of solid adsorption heat pumps: Experiments and numerical simulation economic analysis for development: Final report, 15:48781 (R;LU)

Centre Scientifique et Technique du Batiment, 75 - Paris (France)
Software to estimate the energy production of wind turbine, 15:48482 (R;FR;In French)

Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil)
Does there exist a gravitational analogue of the electro-weak unification, 15:49919 (R;BR)
EPR studies of photolysis of HbNO at low temperatures, 15:50067 (R;BR)
On the thermodynamics of one-fluid Szekeres'like cosmologies, 15:49746 (R;BR)
Proceedings of 6. Latin American School on Theoretical Chemistry. v.1, 15:48986 (R;BR;In Portuguese)
Separable coordinates and particle creation III: Accelerating, Rindler and Milne vacua, 15:49962 (R;BR)
Study of the silica aerogel densifications by SAXS and BET, 15:48909 (R;BR;In Portuguese)

Centro de Desenvolvimento da Tecnologia Nuclear (CDTN), Belo Horizonte, MG (Brazil)
Comparison between the tricaprylylamine and trilaurilamine extrability in uranium and molybdenum extraction of low concentration liquors, 15:48212 (R;BR;In Portuguese)

Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu
Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak", 15:50133 (R;CS;In Russian, English)

Chalmers Univ. of Tech., Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics
Prestudy of burn control in NET: Second intermediate report, February 1990, 15:50113 (R;SE)

Charlton Research Co., San Francisco, CA (USA)
Public attitudes toward Lawrence Livermore National Laboratory: Summary of findings, 15:48701 (R;US)

Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD (USA)
Wear-metal analysis in engine oil by microwave digestion and atomic absorption spectroscopy. Final report, August 1987-January 1988, 15:48988 (R;US)

Chicago Univ., IL (USA)
Correlation of chromosome patterns in leukemic cells of patients with exposure to chemicals and/or radiation: Progress report, January 1–August 20, 1990, 15:49655 (R;US)
Cosmological baryon and lepton number in the presence of electroweak fermion-number violation, 15:49820 (R;US)
Evolution of light domain walls interacting with dark matter, part 1, 15:49821 (R;US)

Cincinnati Univ., OH (USA). Dept. of Chemistry
Electrocatalyst surfaces. Final report, December 1986-November 1989, 15:48762 (R;US)

Clarkson Univ., Potsdam, NY (USA)
Experimental and theoretical studies of friction and heat transfer in rough passages: Progress report, April 15, 1990–July 31, 1990, 15:49179 (R;US)

Colorado State Univ., Fort Collins, CO (USA). Solar Energy Applications Lab.
Colorado State University program for developing, testing, evaluating and optimizing solar heating and cooling systems: Project status report for the months of July and August 1990, 15:48472 (R;US)

Columbia Univ., New York, NY (USA). Dept. of Applied Physics and Nuclear Engineering
High beta and confinement studies on TFTR: Progress report, September 25, 1989–May 24, 1990, 15:50117 (R;US)

Columbia Univ., New York, NY (USA). Henry Krumb School of Mines
Flotation and flocculation chemistry of coal and oxidized coals: Technical progress report, March 15, 1990–June 14, 1990, 15:48083 (R;US)

Commission of the European Communities, Brussels (Belgium)
Industrial processes: Proceedings of a contractors' meeting, 15:48809 (R;LU)

Commission of the European Communities, Luxembourg (Luxembourg)
A desk study of surface diffusion and mass transport in clay, 15:48276 (R;FR)
Adaptation of high pressure water jets with abrasives for nuclear installations dismantling, 15:48651 (R;FR;In French)
An appreciation of the events, models and data used for LMFBR radiological source term estimations, 15:48650 (R;FR)
Application of ADINAT/ADINA and MINIMEF codes to the resolution of the different exercises of COSA project, 15:48270 (R;FR;In Spanish)
CEC project Mirage - Second phase on migration of radionuclides in the geosphere: Second summary progress report (Work period 1988), 15:49734 (R;FR)
CEQCSY: a new code for chemical equilibrium calculation in multiphased systems, 15:48273 (R;FR;In French)
Certification of a uranium-238 dioxide reference material for neutron dosimetry (EC nuclear reference material 501), 15:48994 (R;FR)
Decontamination of concrete by superficial melting with a new burner associated to a plasma (feasibility study), 15:48279 (R;FR;In French)
Extrapolation of stress rupture data on 9 to 12% Cr steels, 15:48871 (R;FR)
Geochemical modelling of the Broubster natural analogue site Caithness, Scotland, 15:48275 (R;FR)
Hydrothermal alterations as natural analogues of radionuclide migration in granitic rocks, 15:48272 (R;FR;In French)
Inherently safe characteristics of nuclear reactors, 15:48532 (R;FR)
Investigation of the potential of fuzzy sets and related approaches for treating uncertainties in radionuclide transfer predictions, 15:48280 (R;FR)
MITRA an advanced code to calculate radionuclide release from nuclear fuels under general irradiation conditions, 15:48619 (R;FR)
Modified sulphur cement: A low porosity encapsulation material for low, medium and alpha waste, 15:48274 (R;FR)
Objectives, standards and criteria for radioactive waste disposal in the European Community: Euradwaste series No 1 Report of a working group on Joint elaboration of radioactive waste-management policies, 15:48281 (R;FR)
Prospects and future utilization, 15:48621 (R;FR;In EN, DE)
Radioactivity measurements in Europe after the Chernobyl accident: Part I: Air, 15:48648 (R;FR)
Selection and development of an easy to process electrolyte for decontamination by electropolishing, 15:48277 (R;FR;In German)
Setting up and experimental validation of the coupling between a geochemical model and a transport model of dissolved elements, 15:48271 (R;FR;In French)

Stress analysis of HLW containers Preliminary ring test exercise Compas project, 15:48278 (R;FR)
Summary report on safety objectives in nuclear power plants, 15:48649 (R;FR)
The nuclear fuel cycle: review on R and D policies in the Member States of the European Communities, 15:48215 (R;FR)
Thermophysical and thermochemical properties of fast reactor materials, 15:48872 (R;FR)

Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation
A passive solar heating facility for existing houses: Demonstration project: Final report, 15:48473 (R;LU)
Absorption heat pumps: Proceedings of a workshop, 15:48807 (R;LU)
Catalytic hydrotreatment of refinery waste: Demonstration project: Final report, 15:48145 (R;LU)
Catalytic treatment of pyrolysis oils, 15:48435 (R;LU)
Development of a high performance air cathode for the direct methanol/air fuel cell: Final report, 15:48761 (R;LU)
Dynamic study of solid adsorption heat pumps: Experiments and numerical simulation economic analysis for development: Final report, 15:48781 (R;LU)
Economic utilization of landfill gas from small and medium-sized waste dumps: Demonstration project: Final report, 15:48829 (R;LU;In English, German)
Energy efficiency in industrial processes: Future R and D requirements: Proceedings of the CEC seminar, 15:48808 (R;LU)
Impact of renewable derived fuels on energy and agriculture sectors: Final report, 15:48411 (R;LU)
Industrial processes: Proceedings of a contractors' meeting, 15:48809 (R;LU)
Multi-stage solid absorption heat transformers for recovery of industrial waste heat: Final report, 15:48810 (R;LU)
Selective steam cracking for energy and raw materials savings: Final report, 15:48137 (R;LU)
Vester Nebel combined collective heat supply system: Demonstration project: Final report, 15:48828 (R;LU)

Commonwealth Science Council, London (UK)
African energy programme, a perspective of a regional project network, 15:48756 (R;GB)

Connecticut Univ., Storrs, CT (USA)
Willapa Bay: A historical perspective and a rationale for research, 15:49593 (R;US)

Consolidation Coal Co., Library, PA (USA). Research and Development Dept.
Stable carbon isotope analysis of coprocessing materials: Quarterly technical progress report, July 1–September 30, 1989, 15:48076 (R;US)

Construction Industry Research and Information Association Underwater Engineering Group (CIRIA/UEG), London (UK)
Effectiveness of concrete to protect steel reinforcement from corrosion in marine structures, 15:49195 (R;GB)

Cornell Univ., Ithaca, NY (USA)
Surface phases and their influence on metal-oxide interfaces: [Progress report], 15:48869 (R;US)

Cornell Univ., Ithaca, NY (USA). Geotechnial Engineering Group
Field evaluation of grillage foundation uplift capacity: Final report, 15:48674 (R;US)

Corps of Engineers, Mobile, AL (USA). Mobile Coastal Section
General design memorandum, Gulfport Harbor, Mississippi. Design Memorandum Number 1. Appendix E. Thin-layer disposal. Final report, 15:49587 (R;US)

Council for Mineral Technology, Randburg (South Africa). Analytical Science Div.
Spectrographic determination of impurities in high-purity tantalum oxide and niobium oxide, 15:49081 (R;ZA)
The preparation of synthetic fusion standards for use in the x-ray-fluorescence analysis of rocks and minerals, 15:49024 (R;ZA)

D

Dames and Moore, Anchorage, AK (USA)
A handbook for management of oil and gas activities on lands in Alaska: Petroleum industry practices, environmental impacts and stipulations, 15:48149 (R;US)

Dayton Univ., OH (USA). Research Inst.
Dynamic properties of porous B_4C. Interim report, 15:49389 (R;US)
Metallurgical processes in multi-component rare earth-transition metal permanent magnet alloys. Final report, 15 May 1987-14 May 1990, 15:48854 (R;US)

Defence Research Establishment, Ottawa, ON (Canada)
Pulse-width dependent radiation effects on electronic components. Technical Note No. 89-33, 15:49399 (R;CA)

Department of Commerce, Boulder, CO (USA). Inst. for Telecommunication Sciences
Distribution of the daily FOF_2 about the monthly median, 15:49859 (R;US)

Department of Energy, London (UK)
Effectiveness of concrete to protect steel reinforcement from corrosion in marine structures, 15:49195 (R;GB)
Wave force experiments at the Christchurch Bay Tower with simulated hard marine fouling, 15:49197 (R;GB)

Department of Energy, London (UK). Offshore Energy Technology Board
Analysis of uncertainties in environmental loading on offshore structures, 15:49196 (R;GB)
Effect of bacterial activity on North Sea concrete, 15:48971 (R;GB)
The loading on offshore structures from breaking waves, 15:49198 (R;GB)

Department of Energy, Mines and Resources, Ottawa, ON (Canada)
The Federal Energy R&D Program: Putting imagination to work, 15:48766 (R;CA)

Department of Energy, Oak Ridge, TN (USA). Oak Ridge Operations Office
Decontamination and decommissioning facility environmental assessment, Feed Materials Production Center, Fernald, Ohio, 15:48261 (R;US)
Thorium handling environmental assessment, Feed Materials Production Center, Fernald, Ohio, 15:48262 (R;US)

Department of Health, London (UK). Supplies Technology Div.
Assessment of a Shimadzu/medical X-ray supplies basic radiographic installation, 15:49694 (R;GB)
Assessment of a Siemens basic radiological installation, 15:49695 (R;GB)
Assessment of the Hitachi Sirius 125 B mobile X-ray Unit at three hospitals, 15:49696 (R;GB)
Report on the use of the Palomex Vision One (Alpha-III) mammographic unit for breast cancer screening, 15:49697 (R;GB)
Report on the use of the Senographe 600TS (SENIXHF) mammographic unit for breast cancer screening, 15:49698 (R;GB)

Department of the Environment, London (UK)
VANDAL technical overview: VANDAL version 1.1, 15:48267 (R;GB)
VANDAL user guide. V. 1.1: Input and execution (VANDAL version 1.1), 15:48264 (R;GB)
VANDAL user guide. V. 1.2: Input and execution appendices (VANDAL version 1.1), 15:48265 (R;GB)
VANDAL user guide. V. 2.1: Output and error messages (VANDAL version 1.1), 15:48266 (R;GB)

Deutsche Forschungsanstalt fuer Luft- und Raumfahrt e.V. (DLR), Koeln (Germany, F.R.)
A computer program system for the analysis of 3-d steady flows in turbomachinery components, 15:49178 (R;DE;In German)

Deutsche Forschungsanstalt fuer Luft- und Raumfahrt e.V. (DLR), Koeln (Germany, F.R.). Bereich fuer Projekttraegerschaften
Metal-matrix composites - a promising alternative to conventional alloys, 15:48908 (R;DE)

DG Engineering, Inc., Livermore, CA (USA)
BWR [Boiling Water Reactor] Owners Group Intergranular Stress Corrosion Cracking Research Program: Executive summary: Phase 2 (1984–1988): Final report, 15:48528 (R;US)

Dijon Univ., 21 (France)
Modelization of the energy demand. Application to the OECD countries, 15:48697 (R;FR;In French)

Dillon (M.M.) Ltd., Ottawa, ON (Canada)
Report of the PCB Working Group, 15:49576 (R;CA)

E

Earth Resources Associates, Helena, MT (USA)
Alluvial valley floor identification and study guidelines. Final report, 15:48103 (R;US)

Ecole Nationale Superieure des Mines, 75 - Paris (France)
Development of an operating aid device for ground water heat pump system, 15:48768 (R;FR;In French)

Ecole Nationale Superieure du Petrole et des Moteurs (ENSPM), 92 - Rueil-Malmaison (France)
Modelization of the energy demand. Application to the OECD countries, 15:48697 (R;FR;In French)

EG and G Idaho, Inc., Idaho Falls, ID (USA)
A microprocessor based charge control system for the simultaneous charging of several batteries with one charge controller: Final report for 1989, 15:48839 (R;US)
Development of a detailed core flow analysis code for prismatic fuel reactors, 15:48572 (R;US)
Effect of calcium sulfate on pool boiling of enhanced heat transfer surfaces, 15:49180 (R;US)
Quantitative analysis of potential performance improvements for the dry PWR [pressurized water reactor] containment, 15:48667 (R;US)
Residual stress at fluid interfaces, 15:48870 (R;US)
Three-dimensional fluid flow in JFTOT [Jet Fuel Thermal Oxidation Tester], 15:49154 (R;US)

EG and G Mound Applied Technologies, Miamisburg, OH (USA)
Interfacing a personal computer to an analog scanning electron microscopy for storing images on optical disks, 15:50235 (R;US)

EG and G Rocky Flats, Inc., Golden, CO (USA)
Statistical calibration and periodic performance checks for segmented gamma scanning, 15:48393 (R;US)

EG and G Rocky Flats, Inc., Golden, CO (USA). Rocky Flats Plant
Anecdotal history of acoustic emission from wood, 15:50104 (R;US)

Electric Power Research Inst., Palo Alto, CA (USA)
BWR [Boiling Water Reactor] Owners Group Intergranular Stress Corrosion Cracking Research Program: Executive summary: Phase 2 (1984–1988): Final report, 15:48528 (R;US)
Cogeneration and independent power production: Market insight and outlook: Final report, 15:48750 (R;US)
DSM [Demand-Side-Management]: Transmission and distribution impacts: Volume 2, Application on spatial frequency analysis: Final report, 15:48749 (R;US)
Fabrication of axial stress corrosion cracks in Alloy 182 weld materials: Final report, 15:48529 (R;US)
Field evaluation of grillage foundation uplift capacity: Final report, 15:48674 (R;US)
Flue gas desulfurization (FGD) chemistry and analytical methods handbook: Volume 1, Process chemistry - Sampling, measurement, laboratory and process performance guidelines (Revision 1): Final report, 15:48514 (R;US)
Geothermal ground-loop preinstallation project at Walden Pond: Final report, 15:48780 (R;US)
Guide for the application and use of valves in power plant systems: Final report, 15:48602 (R;US)
Hydrogen water chemistry fuel surveillance at Dresden-2, 15:48530 (R;US)
International cooling-tower and spray pond symposium: Proceedings, 15:48601 (R;US)
Multiloop Integral System Test (MIST): Final report: MIST phase 4 tests: Volume 11, 15:48665 (R;US)
Multiloop Integral System Test (MIST): Final report: MIST Phase 4 tests, 15:48666 (R;US)
NUHOMS modular spent-fuel storage system: Design, licensing and construction, 15:48233 (R;US)
Solidification in cement of ion-exchange resins from LOMI [Low Oxidation State Metal Ion] decontamination: Final report, 15:48269 (R;US)
The effect of dissolved zinc on the transport of corrosion products in PWRs: Final report, 15:48544 (R;US)

Electricite de France (EDF), 75 - Paris (France)
DER 89: main facts, 15:48736 (R;FR;In French)

Electrotechnical Lab., Tsukuba, Ibaraki (Japan)
Development of the Fresnel-lens-type solar collector, 15:48474 (R;JP)
Latent thermal energy storage using form-stable high-density polyethylene, 15:48475 (R;JP)

Electrowatt Engineering Services Ltd., London (UK)
VANDAL technical overview: VANDAL version 1.1, 15:48267 (R;GB)

Energetics, Inc., Columbia, MD (USA)
Evaluation of a high-temperature burner-duct-recuperator system: A technical case study, 15:48806 (R;US)

Energie-Versorgung Schwaben AG, Stuttgart (Germany, F.R.)
Economic utilization of landfill gas from small and medium-sized waste dumps: Demonstration project: Final report, 15:48829 (R;LU;In English, German)

Energy Conversion Devices, Inc., Troy, MI (USA)
Research on high-efficiency, multiple-gap, multi-junction amorphous silicon-based alloy thin-film solar cells: Final subcontract report, March 1, 1987–February 28, 1990, 15:48464 (R;US)

Energy International, Inc., Bellevue, WA (USA)
Japanese power electronics inverter technology and its impact on the American air conditioning industry, 15:48793 (R;US)

Energy Resources Conservation Board, Calgary, AB (Canada)
Alberta electric industry annual statistics 1987, 15:48754 (R;CA)
Alberta oil and gas industry annual statistics, 1988, 15:48133 (R;CA)
Alberta oil sands annual statistics, 1987, 15:48204 (R;CA)
Alberta's reserves of crude oil, oil sands, gas, natural gas liquids, and sulphur, 15:48131 (R;CA)
Amoco Canada Resources Ltd., Chevron Canada Resources, Kaybob South Beaverhill Lake A pool: Decision 89-9, 15:48184 (R;CA)
Application by Canadian Western Natural Gas Company Limited for a permit to construct a pipeline to transport natural gas in the Magrath area: Decision 89-11, 15:48182 (R;CA)
Chesapeake Resources Ltd. application for a well licence, Whitemud area: Decision 90-3, 15:48168 (R;CA)
Daishowa Canada Ltd., Peace River pulp mill industrial development permit to use gas as a supplementary fuel: Decision 90-7, 15:48185 (R;CA)
Gannon Bros Energy Ltd. application for a well licence, Ewing Lake field: Decision 89-10, 15:48167 (R;CA)
Government of Alberta ethane policy implementation procedures: Information letter 90-9, 15:48186 (R;CA)

Energy Technology Data Exchange, Oak Ridge, TN (USA)
International Energy: Subject Thesaurus, 15:50249 (R;US)

Engineering Interface Ltd. (Canada)
Report to Dept. of Supply and Services on the economics of cool storage for Bell Northern Research Lab 5, Ottawa, Ontario and a comparison of chilled water with three types of ice-storage modules, 15:48688 (R;CA)

Engineering Interface Ltd., Willowdale, ON (Canada)
Economics of cool storage for Bell Northern Research Lab 5, Ottawa, Ontario, and a comparison of chilled water with three types of ice storage modules, 15:48779 (R;CA)

Environmental Advisory Committee on Newfoundland and Labrador Marine Transportation (Canada)
Potential issues associated with shipping oil and gas through the Labrador Sea and Strait of Belle Isle, 15:48170 (R;CA)

Environmental Control Council, Halifax, NS (Canada)
Electrical generating station proposal: Complete verbatim transcript, 15:48515 (R;CA)

Environmental Protection Agency, Ann Arbor, MI (USA). Emission Control Technology Div.
I/m test variability. Technical report, 15:48160 (R;US)

Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards

Reactor processes in synthetic organic chemical manufacturing industry. background information for proposed standards. Draft report, 15:49540 (R;US)

Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response

Delegation of remedy selection to regions. Directive (Final), 15:49580 (R;US)

Delegations of authority under the Federal Water Pollution Control Act (FWPCA) which are applicable to the Superfund program. Directive (Final), 15:48157 (R;US)

Discharge of waste water from CERCLA sites into POTWS. Directive (Final), 15:49612 (R;US)

Emergency response notification system, 15:48158 (R;US)

Involvement of Superfund program managers in Superfund response agreement audits. Directive (Final), 15:48711 (R;US)

Redelegation of authority under CERCLA and SARA. Directive (Final), 15:49581 (R;US)

Results of FY '89 record of decision analysis Superfund management review implementation product. Recommendation No. 25A. Directive (Final), 15:48710 (R;US)

RI/FS improvements follow-up. Final report, 15:48709 (R;US)

Superfund analytical review and oversight. Directive (Final), 15:48707 (R;US)

Superfund Record of Decision (EPA Region 1): New Bedford, MA. (First remedial action), March 1990, 15:49628 (R;US)

Superfund Record of Decision (EPA Region 3): C and R Battery, VA. (First remedial action), March 1990. Final report, 15:49629 (R;US)

Superfund Record of Decision (EPA Region 3): Westline, PA. (First remedial action) (amendment), March 1990, 15:49630 (R;US)

Superfund Record of Decision (EPA Region 2): Roebling Steel, NJ. (First remedial action), March 1990, 15:49631 (R;US)

Superfund: Looking back, looking ahead, 15:48706 (R;US)

Use of Office of Research and Development's bioremediation expertise in Superfund removal program. Directive (Final), 15:48159 (R;US)

Environmental Protection Agency, Washington, DC (USA). Office of Policy, Planning and Evaluation

Report of the Expert Group on Emissions Scenarios of the Response Strategies Working Group of the Intergovernmental Panel on Climate Change. Technical draft report, 15:49541 (R;US)

Report of the Expert Group on Emissions Scenarios of the Response Strategies Working Group of the Intergovernmental Panel on Climate Change. Appendix. Technical report (Draft), 15:49542 (R;US)

Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste

Background document for Third Third wastes to support 40 CFR part 268 land-disposal restrictions. Final rule. Third Third waste volumes, characteristics, and required and available treatment capacity. Volume 1. Executive summary. Chapter 1 and Chapter 2, 15:49578 (R;US)

Background document for Third Third wastes to support 40 CFR part 268 land-disposal restrictions. Final rule. Third Third waste volumes, characteristics, and required and available treatment capacity. Volume 2. Chapter 3, 15:49579 (R;US)

Background document for Third Third wastes to support 40 CFR part 268 land-disposal restrictions. Final rule. Third Third waste volumes, characteristics, and required and available treatment capacity. Volume 3. Chapter 4. Appendix A-Appendix I, 15:49609 (R;US)

Final response to BDAT related comments document, 15:49515 (R;US)

Final response to BDAT related comments document. Volume 1A-1. General BDAT issues, 15:49577 (R;US)

Final response to BDAT related comments document: General BDAT issues. Volume 1-A-2, 15:49516 (R;US)

Final response to BDAT related comments document: General BDAT issues. Volume 1-A-3, 15:49517 (R;US)

Final response to BDAT related comments document: D001. Volume 1-B, 15:49607 (R;US)

Final response to BDAT related comments document: D002. Volume 1-C, 15:49518 (R;US)

Final response to BDAT related comments document. D004: Characteristic wastes for arsenic and K, P, and U wastes containing arsenic and D010: Characteristic wastes for selenium. Volume 1-E, 15:49520 (R;US)

Final response to BDAT related comments document: D005: Characteristic wastes for barium, and P013 and D006: Characteristic wastes for cadmium. Volume 1-F, 15:49521 (R;US)

Final response to BDAT related comments document. D007. Characteristic wastes for chromium. Volume 1-G, 15:49522 (R;US)

Final response to BDAT related comments document: D008: Characteristic wastes for lead and P and U wastes containing lead. Volume 1-H, 15:49523 (R;US)

Final response to BDAT related comments document. D009, K044, K045, K047, D011, P119, P120, and P and U wastes. Volume 1-I, 15:49524 (R;US)

Final response to BDAT related comments document. Mixed radioactive hazardous wastes, polynuclear aromatic u wastes, halogenated aliphatic U wastes, non-halogenated aromatic U wastes, F002-f006, F019. Volume 1-J, 15:49525 (R;US)

Final response to BDAT related comments document. F025, K002-K008, K011, K013-15, K046, K061, K069. volume 1-k, 15:49526 (R;US)

Final response to BDAT related comments document. K071 and K106: Mercury cell process wastes K086: Residues from ink production wastes containing cyanide. Volume 1-L, 15:49608 (R;US)

Final response to BDAT related comments document. K017/K028-K029, K095-096, K022, K025, K035, K026, K083, K024. Volume 1-M, 15:49527 (R;US)

Final response to BDAT related comments document. Halogenated organic wastes. Volume 1-N, 15:49528 (R;US)

Final response to BDAT related comments document. K043-K052, K036, K037. Volume 1-O, 15:48147 (R;US)

Final response to BDAT related comments document. Leachates. Volume 1-P, 15:49529 (R;US)

Final response to BDAT related comments document. Volume 1-Q, 15:49530 (R;US)

Final response to BDATt related comments document D003. Volume 1-D, 15:49519 (R;US)

Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste and Emergency Response

CERCLA off-site policy: Providing notice to facilities. Final report, 15:48708 (R;US)

Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement

Site Enforcement Tracking System (SETS) (Region 1) (for microcomputers). Data file, 15:48714 (R;US)

Site Enforcement Tracking System (SETS) (Region 2) (for microcomputers). Data file, 15:48715 (R;US)

Site Enforcement Tracking System (SETS) (Region 3) (for microcomputers). Data file, 15:48716 (R;US)

Site Enforcement Tracking System (SETS) (Region 4) (for microcomputers). Data file, 15:48717 (R;US)

Site Enforcement Tracking System (SETS) (Region 5) (for microcomputers). Data file, 15:48718 (R;US)

Site Enforcement Tracking System (SETs) (Region 6) (for microcomputers). Data file, 15:48719 (R;US)

Site Enforcement Tracking System (SETs) (Region 7) (for microcomputers). Data file, 15:48720 (R;US)

Site Enforcement Tracking System (SETs) (Region 8) (for microcomputers). Data file, 15:48721 (R;US)

Site Enforcement Tracking System (SETs) (Region 9) (for microcomputers). Data file, 15:48722 (R;US)

Site Enforcement Tracking System (SETts) (Region 10) (for microcomputers). Data file, 15:48723 (R;US)

Site Enforcement Tracking System (SETs) (National) (for microcomputers). Data file, 15:48724 (R;US)

Site enforcement tracking system (SETS) (national). Data file, 15:48725 (R;US)

Environmental Studies Research Funds, Ottawa, ON (Canada)

Environmental Studies Research Funds annual report, 1989, 15:48747 (R;CA)

Erevanskij Fizicheskij Inst., Erevan (USSR)
- 32-input gating circuit for event selection, 15:49291 (R;SU;In Russian)
- Basic circuit of synchrotron power supply on standard units, 15:49247 (R;SU)
- Characteristics of the electron beam extracted onto the Deuteron-2 installation in the low background room of the Erevan synchrotron, 15:49248 (R;SU;In Russian)
- Experimental set-up for investigation of high-energy electrons scattering and radiation during their channeling in monocrystals, 15:49245 (R;SU;In Russian)
- Identification of cosmic heavy nuclei in an assembly of nuclear photoemulsions and dielectric track detectors, 15:49292 (R;SU;In Russian)
- Low-pressure chamber for registration of fission fragments of heavy nuclei, 15:49289 (R;SU)
- Modernization of the VMR-2 monochromator and its use in a synchrotron radiation channel, 15:49243 (R;SU;In Russian)
- On the possibility of oscillation damping in strong-focusing accelerator by spontaneous radiation, 15:49231 (R;SU;In Russian)
- Optimal transition X radiation detectors for particle identification in a wide energy range, 15:49290 (R;SU;In Russian)
- Optimization of the shape of the bending magnets cross section for electron accelerators and storage rings, 15:49246 (R;SU)
- Technique for investigation of hadron groups in ionization calorimeter, 15:49288 (R;SU;In Russian)
- The estimate of the threshold energy of Yerevan synchrotron with a new accelerating system, 15:49244 (R;SU;In Russian)

European Space Agency, 75 - Paris (France)
- Infrared spectroscopy in astronomy: Proceedings of the 22 Eslab Symposium, 15:49750 (R;FR)

F

Fermi National Accelerator Lab., Batavia, IL (USA)
- An investigation of thermally driven acoustical oscillations in helium systems, 15:49251 (R;US)
- CANVAS: C++ objects for easy graphics on an Evans and Sutherland PS390 terminal: User's guide, 15:50216 (R;US)
- Chiral interface at the finite temperature transition point of QCD, 15:50048 (R;US)
- Mechanical support of superconducting coils, 15:49250 (R;US)
- Operation of a 2-phase return dewar in a satellite refrigerator, 15:49252 (R;US)
- Periodic signatures for the detection of cosmic axions, 15:49819 (R;US)

Fish and Wildlife Service, Slidell, LA (USA). National Coastal Ecosystems Team
- Texas Barrier Islands Region ecological characterization atlas: Biological resources narrative, 15:49570 (R;US)

Fish and Wildlife Service, Washington, DC (USA)
- Willapa Bay: A historical perspective and a rationale for research, 15:49593 (R;US)

Fish and Wildlife Service, Washington, DC (USA). Div. of Biological Services
- A handbook for management of oil and gas activities on lands in Alaska: Petroleum industry practices, environmental impacts and stipulations, 15:48149 (R;US)

Florida State Univ., Tallahassee, FL (USA)
- Searching for 100–300 GeV gluinos at the Tevatron and SSC, 15:49907 (R;US)

Florida State Univ., Tallahassee, FL (USA). Dept. of Physics
- CAD tools for detector design, 15:49293 (R;US)
- Task A, High energy physics program experiment and theory: Task B, High energy physics program numerical simulation: Part 1 and 2, Progress report August 1, 1989–July 31, 1990, 15:49900 (R;US)

Florida State Univ., Tallahassee, FL (USA). High Energy Physics Lab.
- The search for very heavy top and the fourth generation, 15:49908 (R;US)

Foreign Technology Div., Wright-Patterson AFB, OH (USA)
- Geologic interpretation of gravity anomalies, 15:48124 (R;US)
- Study of constitution diagram aluminum-tantalum, 15:48856 (R;US)

Forest Engineering Research Inst. of Canada, Pointe Claire, PQ (Canada)
- Handbook for small-to-medium size fuelwood chipping operations, 15:48412 (R;CA)

Forest Service, Ogden, UT (USA). Intermountain Research Station
- Relationship of fuel size and spacing to combustion characteristics of laboratory fuel cribs. Forest Service research paper, 15:48437 (R;US)

Foster Wheeler USA Corp., Clinton, NJ (USA)
- Assessment of modular IGCC plants based on entrained flow coal gasification supplemental studies, 15:48489 (R;US)

Foster-Miller, Inc., Waltham, MA (USA)
- State-of-the-art interior-piping-systems application: On-site H_2S/O_2 removal technology. Final report, June 1988-March 1989, 15:48190 (R;US)

Frank J. Seiler Research Lab., United States Air Force Academy, CO (USA)
- Evaluation of room-temperature chloroaluminate molten salts as electrolytes for high energy density batteries. Final report, June 1988-April 1990, 15:48691 (R;US)

Franklin McLean Memorial Research Inst., Chicago, IL (USA)
- Nuclear medicine and imaging research (quantitative studies in radiopharmaceutical science): Progress report, January 1–September 1, 1990, 15:49688 (R;US)
- Nuclear medicine and quantitative imaging research (instrumentation and quantitative methods of evaluation): Progress report, January 15–September 1, 1990, 15:49687 (R;US)

Freie Univ. Berlin (Germany, F.R.)
- Investigation of the permeation of radiocontrast agent into the experimentally irritated stratum corneum, 15:49692 (R;DE;In German)
- Results and hazards of postoperative radiotherapy using orthovoltage (300 kV) in carcinomas of the breast, 15:49690 (R;DE;In German)
- The role of CT in follow-up treatment of patients after proctectomy due to a carcinoma: A retrospective study of 93 patients, 15:49691 (R;DE;In German)

G

Gas Research Inst., Chicago, IL (USA)
- Gas Research Institute 1991-1995 research and development plan and 1991 research and development program, 15:48177 (R;US)
- Physical Sciences Program Area 1990 contract status report, 15:48178 (R;US)

General Atomics, San Diego, CA (USA)
- A review of reactor physics uncertainties and validation requirements for the modular high-temperature gas-cooled reactor, 15:48573 (R;US)

General Electric Co., Pleasanton, CA (USA). Vallecitos Nuclear Center
- Hydrogen water chemistry fuel surveillance at Dresden-2, 15:48530 (R;US)

General Electric Co., Richland, WA (USA). Hanford Atomic Products Operation
- Engineering study: Improved facilities for the removal of Iodine-131 from Purex process vent off-gas, 15:48225 (R;US)

General Electric Co., San Jose, CA (USA). Nuclear Energy Div.
- Fabrication of axial stress corrosion cracks in Alloy 182 weld materials: Final report, 15:48529 (R;US)

Geological Survey of Canada, Ottawa, ON (Canada)
- Current research, part F. Frontier Geoscience Program. Cordilleran and offshore basins, British Columbia, 15:49735 (R;CA)
- Uppermost Devonian and lower Carboniferous stratigraphy, sedimentation, and diagenesis, southwestern District of Mackenzie and southeastern Yukon Territory (NTS 95 B, C, F, and G), 15:49736 (R;CA)

Georgia Univ., Athens, GA (USA). Georgia Cooperative Fish and Wildlife Research Unit
- Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): Striped bass, 15:49588 (R;US)

Georgia Univ., Athens, GA (USA). School of Forest Resources
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): Striped bass, 15:49588 (R;US)

Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Hydrologie
Annual report 1988 of the GSF Institute of Hydrology, 15:49594 (R;DE;In German)

Ghent Rijksuniversiteit (Belgium). Lab. voor Petrochemische Techniek
Selective steam cracking for energy and raw materials savings: Final report, 15:48137 (R;LU)

Golder Associates, Mississauga, ON (Canada)
Review and evaluation of main roadway intersection techniques for use in the Sydney coal field, 15:48102 (R;CA)

Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii
Analysis of inhomogeneities of reactor fuel assemblies using statistics criteria, 15:48596 (R;SU;In Russian)
Cosmic ray production in plasma z pinches, 15:49809 (R;SU;In Russian)
Diagnostics of impurity and neutral components of tokamak plasma by the resonance fluorescence method, 15:50130 (R;SU;In Russian)
Dissociative recombination of molecular ions H_2^+, 15:49875 (R;SU;In Russian)
Electron distribution function and rate constants of elementary processes in a tokamak near-wall plasma, 15:50128 (R;SU;In Russian)
Equilibrium of plasma filament with inhomogeneous field along on axis and without of longitudinal current, 15:50129 (R;SU;In Russian)
Filamentation in quark plasma at finite temperatures, 15:49925 (R;SU;In Russian)
FORTUN-88 physical module for calculation by Monte-Carlo method with microconstants on the estimated data file basis, 15:50054 (R;SU;In Russian)
Gas jet magnetic compression dynamics, 15:50124 (R;SU;In Russian)
Kinetic limitations on sausage compression of Z-pinches, 15:50122 (R;SU;In Russian)
Low-energy conversion electrons from primary fragments of uranium 235 fission by thermal neutrons, 15:50016 (R;SU;In Russian)
Methods of superchronous processing of signals in high-temperature plasma diagnostics, 15:50127 (R;SU;In Russian)
Nonlinear development of two-dimensional axial-symmetric MGD instability in a Z-pinch, 15:50123 (R;SU;In Russian)
Optimization of kinematically complete experiments in four-particle nuclear reactions by simulation method, 15:50027 (R;SU;In Russian)
Plane channeling and radiation of ultrarelativistic electrons in thick crystals, 15:50070 (R;SU;In Russian)
Possibility of using first collision probability method for solution of the problem of photon transport, 15:50125 (R;SU;In Russian)
Quasiequilibrium evolution of compact torus with toroidal field, 15:50176 (R;SU;In Russian)
Resonating-group method in calculations of low-energy reactions and n^4He scattering with realistic NN interactions, 15:50026 (R;SU;In Russian)
Statistical simulation of Coulomb collisions in a plasma, 15:50131 (R;SU;In Russian)
Strength function of xenon 127 and cross section of $^{127}I(\nu_e, e^-)^{127}Xe$ reaction, 15:50028 (R;SU;In Russian)
Study on centrifugal acceleration of hydrogen pellets, 15:50175 (R;SU;In Russian)
Study on the effect of main performance of Si-surface-barrier detectors of different area on the noise and timing parameters of a charged particle spectrometer, 15:49294 (R;SU;In Russian)
Study on the main performance of charged particle multichannel spectrometers at high input counting rates, 15:49295 (R;SU;In Russian)
Synthesis of oneparticle excitation from two giant quantum monopoles, 15:50093 (R;SU;In Russian)
Technique for calculation of electrostatic fields of high-current accelerator elements, 15:50174 (R;SU;In Russian)
TEMP-8 module. Calculation of reactor point kinetics with increased accuracy, 15:48595 (R;SU;In Russian)
Thermodynamics of steam-turbine cycle with minimum coolant flow rate, 15:48603 (R;SU;In Russian)
Thomson scattering equipment for investigation of plasma filament scrape-off layer at the T-10 tokamak, 15:50126 (R;SU;In Russian)
Unified geometric theory of gravitation and electromagnetism: 5. Gravitational collapse and scalar radiation, 15:49810 (R;SU;In Russian)
Vacuum polarization of electromagnetic field and electrodynamic processes on nucleus, 15:49897 (R;SU;In Russian)

Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki
Analysis of the reaction p-barp→Λ-barΛ near the threshold, 15:49940 (R;SU)
Cumulative K^--meson production by protons with energy of 10 GeV, 15:49988 (R;SU;In Russian)
Cumulative nucleon production in ^3Hep- and ^3Hp interactions at momenta of colliding nuclei 5 GeV/c, 15:49997 (R;SU;In Russian)
Experimental studying the altitude distribution of the $^{63}Cu(n,\gamma)$ reaction rates in the model of the TVR-M reactor core, 15:48627 (R;SU;In Russian)
Experimental studying the azimuthal-radial distributions of the $^{63}Cu(n,\gamma)$ reaction rates in the model of the TVR-M reactor core, 15:48628 (R;SU;In Russian)
Experimental studying the effects of horizontal experimental channels on the neutron field in the model of the TVR-M research reactor core, 15:48629 (R;SU;In Russian)
Floquet functions in accelerating-focusing channel with an arbitrary structure of a period, 15:49233 (R;SU;In Russian)
GITTAM code for numerical simulation of one-dimensional targets for heavy ion fusion. Part 1: Pt.1 System of equations, 15:50177 (R;SU;In Russian)
GITTAM program for numerical simulation of one-dimensional targets TIS. Part 2: 2. Description of algorithm and program, 15:50219 (R;SU;In Russian)
GITTAM program for numerical simulation of one-dimensional targets TIS. Part 3: 3. Testing calculations, 15:50178 (R;SU;In Russian)
Increase of strip beam emittance in linear focusing systems, 15:49234 (R;SU;In Russian)
Maximum compression of Z-pinch in a gas with high atomic number, 15:50150 (R;SU;In Russian)
Photoemulsion vertex detector at the SKIF installation, 15:49304 (R;SU;In Russian)
Possibility of experiments using radiation counters for test electron stability and Pauli principle violation in atoms, 15:49303 (R;SU;In Russian)
Production of high energy nuclei ^4He,^3He,^3H,^2H in interaction 10.1 GeV/c protons with Be,Al,Cu,Ta, 15:50032 (R;SU)
Quantization with acount of barrier permeability, 15:50098 (R;SU;In Russian)
Quantum chromodynamics with infinite number of vector mesons, 15:49941 (R;SU)
Sparking limit of the accelerating gap of the heavy ion accelerator, 15:49258 (R;SU)
Study on charge exchange and radiation resistance of carbon targets in the I-2 proton linear accelerator, 15:49257 (R;SU;In Russian)
Topics in low-energy p-barp interactions, 15:49942 (R;SU)
TRECD program for three-dimensional calculation of a heterogeneous reactor in dipole approximation, 15:48597 (R;SU;In Russian)

Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.
Collective bands in actinide nuclei and rare-earth elements in the SU(3) scheme, 15:50025 (R;SU;In Russian)
FEhl pulse spectrometric neutron generator, 15:49228 (R;SU;In Russian)

Nuclear reaction cross sections recommended as the standards for neutron measurements, 15:49981 (R;SU;In Russian)
Study on beam injection systems of the EhGP-10M charge-exchange electrostatic accelerator, 15:49249 (R;SU;In Russian)
To the problem of optimization of external and integral iteration algorithm in diffusion calculation of nuclear reactor, 15:48594 (R;SU;In Russian)

Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij
Amplitude detector, 15:49255 (R;SU;In Russian)
Application of the high-current wire photodetector for Cherenkov radiation ring detecting: Recent progress and future development, 15:49297 (R;SU;In Russian)
Computer calculation of the powerful tube generator for accelerator HF power supply system, 15:49254 (R;SU;In Russian)
Determination of value of the $\sigma(\nu\text{-barn}\rightarrow\mu^{\pm}X)\sigma(\nu\text{-barp}\rightarrow\mu^{\pm}X)$ cross section ratio at neutrino energies up to 30 GeV, 15:49928 (R;SU;In Russian)
Digital Hall magnetometer, 15:49383 (R;SU;In Russian)
Distributed computer system based on local area network ALISA in experimental investigations, 15:50217 (R;SU;In Russian)
Excited quark production at ep and γp colliders, 15:49933 (R;SU)
Fast-cycling minidrift chamber with freon-14 (80%) and isobutan (20%) mixture, 15:49299 (R;SU;In Russian)
Fiber-optical systems in physical experiment technique. Part 1: Part 1: Concepts and components, 15:49378 (R;SU;In Russian)
Investigation of radiation stability of low-noise transistors, 15:49365 (R;SU;In Russian)
Massive straight-line string as a model of heavy quarkonium, 15:49932 (R;SU;In Russian)
Mathematical model and program for superconducting magnet mechanics study, 15:49256 (R;SU;In Russian)
Measurement of the longitudinal thermal conductivity for spiral tube-fin heat exchanger structure for helium facilities, 15:49181 (R;SU;In Russian)
Minidrift chambers. Operation with different gas mixtures, 15:49296 (R;SU;In Russian)
Model of chromoelectric charges confinement, 15:49930 (R;SU)
Numerical study of equation for gluonic cascade with recombination, 15:49936 (R;SU)
On energy dependence of the width and shape of the rapidity distribution of negatively charged particles, 15:49927 (R;SU;In Russian)
On integrating of a singular integro-differential equation, 15:50096 (R;SU;In Russian)
On interpreting the results of personnel dosimeter intercomparison, 15:49301 (R;SU;In Russian)
On mixing of states in relativistic-invariant theory, 15:49937 (R;SU;In Russian)
On POLEX experiment at UNK, 15:49278 (R;SU;In Russian)
One-gluon exchange approximation for quasipotential of two-quark interaction in quantum chromodynamics, 15:49929 (R;SU)
Perspectives of experimental study of electromagnetic form factors of unstable particles at UNK, 15:49911 (R;SU;In Russian)
Processing of the information from gamma detector at SIGMA-AJAX setup, 15:49307 (R;SU;In Russian)
Relativistic massive particle with higher curvatures as a model for description of bosons and fermions, 15:49935 (R;SU)
Single-time reduction of bethe-salpeter formalism for two-fermion system, 15:49966 (R;SU)
Spatial resolution of electromagnetic liquid krypton calorimeter: Monte-Carlo simulation, 15:49300 (R;SU;In Russian)
Specialized processor for particle momentum selection in the experiment to study of central hadron collisions, 15:49298 (R;SU;In Russian)
Strange meson mass spectrum in relativistic model for quasi-independent quarks, 15:49934 (R;SU)
Study on the $\pi^+\rightarrow\eta$ and $\pi^+\rightarrow\pi^0\pi^0$ exclusive processes on nuclei at 10.5 GeV/c, 15:49910 (R;SU;In Russian)
Supersymmetric version of horizontal gauge interactions, 15:49931 (R;SU)
The development and tests of high-power Y-circulator of the metre-wave range, 15:49253 (R;SU;In Russian)

Grambling State Univ., LA (USA). Dept. of Industrial and Engineering Technology
Redesigning local transportation service for improved suburban mobility: The problem of accessibility for the elderly and low-income residents. Final report, 1 January 1989-31 May 1990, 15:48803 (R;US)

Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)
Central collisions at the fermi energy, 15:50012 (R;FR)
Level density parameter of nuclei at finite temperature, 15:50008 (R;FR)

Grenoble-1 Univ., 38 (France)
Study of the linear momentum transfer distribution in the ^{40} Ar + ^{12}C system at 27, 32, 36, 40, 44 and 60 MeV/A, 15:49998 (R;FR;In French)

Groningen Rijksuniversiteit (Netherlands). Computing Science Section
Controlling real-time systems with parallel processes, 15:50238 (R;NL)

Groupement Europeen de Recherches Technologiques sur les Hydrocarbures (GERTH), 92 - Rueil-Malmaison (France)
Catalytic hydrotreatment of refinery waste: Demonstration project: Final report, 15:48145 (R;LU)
Selective steam cracking for energy and raw materials savings: Final report, 15:48137 (R;LU)

H

Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences
Theory of ceramic/zirconia composites: Toughening, strengthening, and synergism, 15:48904 (R;US)

Harvard-Smithsonian Center for Astrophysics, Cambridge, MA (USA)
Observations of Cygnus X-2 with IUE: Ultraviolet results from a multiwavelength campaign, 15:49837 (B;DE)

Health and Welfare Canada, Ottawa, ON (Canada)
Electric and magnetic fields and your health: A report of the Working Group on Electric and Magnetic ELP Fields, 15:49727 (R;CA)

Hedgpeth (Joel W.), Santa Rosa, CA (USA)
Willapa Bay: A historical perspective and a rationale for research, 15:49593 (R;US)

Hellpump Corp., Cleveland, OH (USA)
Simultaneous particulates NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 2, October 1, 1987–December 31, 1987, 15:48504 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 1, July 15, 1987–October 1, 1987, 15:48503 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 3, January 1, 1988–March 31, 1988, 15:48505 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 4, April 1, 1988–June 30, 1988, 15:48506 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 5, July 1, 1988–September 30, 1988, 15:48507 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 6, October 1, 1988–December 31, 1988, 15:48508 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemcial technology: Technical progress report No. 7, January 1, 1989–March 31, 1989, 15:48509 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 8, April 1, 1989–June 30, 1989, 15:48510 (R;US)
Simultaneous particulates, NOx_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 9, July 1, 1989–September 30, 1989, 15:48511 (R;US)

Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Heating, Ventilation and Air Conditioning
The development of an integrating tracer gas method for ventilation measurements, 15:48796 (R;FI;In Finnish)

Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Thermal Engineering
Manufacture of air electrodes and long run tests, 15:48763 (R;FI)

Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics
Correlation function of gravitational deflection angles of light paths, 15:50105 (R;JP)

Hitachi Ltd., Tokyo (Japan)
Development of high-Tc superconducting wire with high critical current density, 15:48935 (R;JP)
Field-effect superconducting transistor, 15:49215 (R;JP)
Key technologies of superconducting generator, 15:49214 (R;JP)
Preparation and structural characterization of Tl-Sr-Ca-Cu-O superconducting materials, 15:48934 (R;JP)

Howe (C.D.) Inst., Toronto, ON (Canada)
Field investigation of domestic hot water tanks as space heating appliances: Final report, 15:48782 (R;CA)

I

IGR Enterprises, Beachwood, OH (USA)
Simultaneous particulates NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 2, October 1, 1987–December 31, 1987, 15:48504 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 1, July 15, 1987–October 1, 1987, 15:48503 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 3, January 1, 1988–March 31, 1988, 15:48505 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 4, April 1, 1988–June 30, 1988, 15:48506 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 5, July 1, 1988–September 30, 1988, 15:48507 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 6, October 1, 1988–December 31, 1988, 15:48508 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemcial technology: Technical progress report No. 7, January 1, 1989–March 31, 1989, 15:48509 (R;US)

IIT Research Inst., Chicago, IL (USA)
Recycling of electric-arc-furnace dust, 15:48824 (R;US)

Illinois Environmental Protection Agency, Springfield, IL (USA). Div. of Water Pollution Control
Illinois water-quality report, 1988-1989. Final report, 15:49618 (R;US)

Illinois Inst. of Tech., Chicago, IL (USA). Dept. of Chemical Engineering
Computer modeling of a CFB [circulating fluidized bed] gasifier: Third technical progress report, 15:48111 (R;US)

Illinois Univ., Chicago, IL (USA)
Thermal relics: Do we know their abundances, 15:49822 (R;US)

Illinois Univ., Urbana, IL (USA)
Can a Pb/SCIFI calorimeter survive the SSC?, 15:49286 (R;US)
Effect of interfacial characteristics on the mechanical performance of ceramic-ceramic composites. Final report, July 1986-December 1989, 15:48906 (R;US)

Illinois Univ., Urbana, IL (USA). Dept. of Civil Engineering
Anaerobic fluid-bed treatment of coal conversion wastewater: Tenth quarterly technical progress report, November 15, 1988–February 15, 1988, 15:48093 (R;US)

Illinois Univ., Urbana, IL (USA). Dept. of Mechanical and Industrial Engineering
Co-firing of natural gas and coal. Annual report, October 1988-September 1989, 15:48121 (R;US)

Illinois Univ., Urbana, IL (USA). Dept. of Nuclear Engineering
CTR plasma engineering studies: Annual progress report, December 1, 1989–November 30, 1990, 15:50114 (R;US)

Imperial Coll. of Science and Technology, London (UK)
Effect of bacterial activity on North Sea concrete, 15:48971 (R;GB)
The combustion of liquid fuels, 15:48176 (R;GB)

Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison (France)
Modelization of the energy demand. Application to the OECD countries, 15:48697 (R;FR;In French)

Institut National des Sciences Appliquees (INSA), 69 - Villeurbanne (France)
Modelization and PC-based control of a distillation column - heat pump system, 15:48811 (R;FR;In French)
Study of radiation effects on zircaloy 4 microstructure (impact on susceptibility to fuel pellet-cladding interaction in PWR), 15:48873 (R;FR;In French)

Institute of Gas Technology, Chicago, IL (USA)
Determination of flow-regime boundaries for cohesive particles: Quarterly report, September 20–December 19, 1989, 15:48210 (R;US)
Determination of flow-regime boundaries for cohesive particles: Quarterly report, December 20, 1989–March 20, 1990, 15:48211 (R;US)

Institute of Metals, London (UK)
Application of ion beam sputtering for diffusion study in solids, 15:50065 (R;GB)
Crosslinking of thermoplastics by gamma-irradiation in industrial conditions, 15:48401 (R;GB)

Institute of Space and Aeronautical Science, Sagamihara, Kanagawa (Japan)
High energy particle experiment for the GEOTAIL mission: GEOTAIL HEP, 15:49811 (R;JP)

Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)
"In vitro" and "in vivo" studies 2,6 - diisopropyl-fenil-carboilmethyl iminodiacetic acid labeled with ^{99m}Tc (Disida -^{99m}Tc), 15:49713 (R;BR;In Portuguese)
Determination of the stacking fault energies of face centured cubic metals and alloys by X-rays diffraction, 15:48875 (R;BR;In Portuguese)
Isolation and purification of rabbit imunoglobulin (IgG) for the production of a second antibody for radioimunoassay, 15:49693 (R;BR;In Portuguese)
Miniaturized chromatographic radiochemical procedure for ^{131}I - MIBG, 15:49148 (R;BR)
Simplified model of a PWR primary circuit, 15:48561 (R;BR;In Portuguese)

International Atomic Energy Agency, Vienna (Austria)
Agreement of 2 October 1989 between the Socialist Republic of Viet Nam and the International Atomic Energy Agency for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons, 15:48390 (R;XA)
Agreement of 24 February 1989 between the Republic of Tunisia and the International Atomic Energy Agency for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons, 15:48391 (R;XA)
Communications received from Members regarding the export of nuclear material and of certain categories of equipment and other material: A further communication dated 8 May 1990, 15:48396 (R;XA)
Communications received from Members regarding the export of nuclear material and of certain categories of equipment and other material: A further communication dated 9 May 1990, 15:48397 (R;XA)
Communications received from Members regarding the export of nuclear material and of certain categories of equipment and other material: Further communications dated 1 June 1990, 15:48398 (R;XA)
Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48653 (R;XA)
Fluctuations and stability in the Advanced Toroidal Facility (ATF) torsatron, 15:50132 (R;US)
Information on economic and social consequences of the Chernobyl accident, 15:48652 (R;XA)
Request by the Resident Representative of Iraq, 15:49398 (R;XA)
Retention of alkaline earth elements in man: Final report for the period 1 April 1986 - 14 May 1989, 15:49712 (R;XA)

Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988, 15:48242 (R;XA)
Texts of joint USA-USSR statements following the summit meeting in Washington, D.C., 31 May - 3 June 1990, 15:48848 (R;XA)
The text of the Agreement of 12 July 1973 between Costa Rica and the Agency for the application of safeguards in connection with the Treaty for the Prohibition of Nuclear Weapons in Latin America and the Treaty on the Non-Proliferation of Nuclear Weapons, 15:48389 (R;XA)
Twentieth anniversary of the entry into force of the Treaty on the Non-Proliferation of Nuclear Weapons, 15:48847 (R;XA)

International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee
Consistency of microscopic evaluations and integral experiments for chromium, iron and nickel, 15:50009 (R;XA)
Neutron cross-section evaluation for ^{15}N, 15:49999 (R;XA)
The neutron leakage spectrum for an iron sphere with a central 14 MeV neutron source, 15:50056 (R;XA)

International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components
Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components, Vienna, 18-20 October 1988: Summary report, 15:48520 (R;XA)

International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section
ACTIV87 Fast neutron activation cross section file 1987, 15:49985 (R;XA)
BROND: USSR Evaluated Neutron Data Library, 15:49984 (R;XA)
ENDF/B-4: General purpose file 1974. Summary of contents and documentation, 15:50252 (R;XA)
Index of data libraries available on magnetic tape from the IAEA Nuclear Data Section, 15:50251 (R;XA)
Index to the IAEA-NDS-Documentation Series, 15:50250 (R;XA)
JENDL fission product nuclear data libraries: Contents and documentation, 15:49983 (R;XA)
Thermal-neutron capture gamma-rays, 15:49987 (R;XA)
"ACTV-F/H" Neutron activation cross-section library for fusion reactor design: Data from the Hanford REAC*2 Data Library, 15:49986 (R;XA)

International Fuel Cells Corp., South Windsor, CT (USA)
Molten carbonate fuel cell power plant systems studies, 15:48490 (R;US)

Iowa State Univ. of Science and Technology, Ames, IA (USA)
Fatigue crack characterization by ultrasonic inspection, 15:49189 (R;US)
Granular and superconducting-glass properties of the high-temperature superconductors, 15:48920 (R;US)
Iowa State Mining and Mineral Resources Research Institute: Semi-annual report, July 1, 1989–December 31, 1989, 15:49738 (R;US)
Measurement and control of coal hydrophobicity, 15:48088 (R;US)
NMR [nuclear magnetic resonance] studies of hydrogen in metals and hydrides at very high temperatures, 15:50074 (R;US)
The stabilization and utilization of coal solid wastes, 15:48095 (R;US)
Transient infrared emission spectroscopy, 15:48996 (R;US)

Iowa State Univ. of Science and Technology, Ames, IA (USA). Dept. of Chemistry
^{31}P NMR analysis of coal moieties bearing -OH, -NH and -SH functions: Quarterly report, April 1, 1990–June 30, 1990, 15:48086 (R;US)

Iowa State Univ. of Science and Technology, Ames, IA (USA). Engineering Research Inst.
A resistance wire technique applied to heat transfer measurements in high aspect ratio fluidized beds, 15:48115 (R;US)
Heat transfer in a two-bed fluidized combustor, 15:48114 (R;US)

Iowa State Univ. of Science and Technology, Ames, IA (USA). Iowa State Mining and Mineral Resources Research Inst.
Iowa State Mining and Mineral Resources Research Institute final report, July 1, 1988–June 30, 1989, 15:49737 (R;US)

J

Japan Atomic Energy Research Inst., Tokyo (Japan)
A method of using the inverse matrix for manipulator kinematics, 15:49162 (R;JP;In Japanese)
A study on steam reforming process using nuclear heat of VHTR, 15:48576 (R;JP;In Japanese)
An intermediate break BWR LOCA test (RUN 991) at ROSA-III: Simulation of ECCS line break LOCA phenomena, 15:48656 (R;JP)
Analysis method of fractional release of cesium from fuel elements of HTTR, 15:48630 (R;JP;In Japanese)
Automatic remote communication system: Development of the upgraded RECOVER system, 15:48392 (R;JP;In Japanese)
Behavior of radioactive organic iodide in an atmosphere of High Temperature Gas-cooled Reactor, 15:49149 (R;JP;In Japanese)
Density limit in JT-60, 15:50156 (R;JP)
Design, construction and performance tests of atomic emission spectrograph with DCA and ICP excitation systems for plutonium bearing fuels, 15:48997 (R;JP;In Japanese)
Development of THYDE-HTGR: computer code for transient thermal-hydraulics of high-temperature gas-cooled reactor, 15:48575 (R;JP)
Effects of environment and aging on creep properties of Alloy 800H, 15:48882 (R;JP;In Japanese)
Estimation of energy deposition in various test fuels in the NSRR FBR fuel tests, 15:48583 (R;JP;In Japanese)
Evaluation of water flow velocity, dispersion length and retardation factor in radionuclide migration test using undisturbed samples of aerated sandy soil layer, 15:49572 (R;JP;In Japanese)
Evaluation report on SCTF Core-III Test S3-20: Investigation of water break-through and core cooling behaviors under intermittent ECC water delivery to upper plenum during reflood phase in PWRs with combined-injection type ECCS, 15:48657 (R;JP)
Isolation and properties of plasmids from Deinococcus radiodurans Sark, 15:49714 (R;JP)
Manufacturing of superconducting wiggler coil, 15:49279 (R;JP;In Japanese)
Monte Carlo codes and Monte Carlo simulator program, 15:50221 (R;JP;In Japanese)
Report of the seminar on nuclear physics and atomic physics at the JAERI tandem-booster accelerator, 15:49259 (R;JP)
Review of JT-60 experimental results from January to October, 1989, 15:50155 (R;JP)
Safety demonstration test plan in the High Temperature Engineering Test Reactor (HTTR) and safety evaluation, 15:48655 (R;JP;In Japanese)
The design and construction of the neutron guide tubes in JRR-3, 15:48631 (R;JP;In Japanese)
Volume reduction of ion exchange resins by catalytic incineration, 3: Investigation of overall reaction rate, 15:48283 (R;JP;In Japanese)

Joensuu Univ. (Finland)
The optical parametrization of an aerial multispectral camera, 15:49599 (R;FI)

Joint Inst. for Nuclear Research, Dubna (USSR)
Experimental studies of effect of high current pulse electron and carbon ion beams on high temperature Y-Ba-Cu-O, Bi-Ca-Sr-Cu-O superconductors, 15:50078 (R;SU;In Russian)
JINR rapid communications: Collection, 15:49745 (R;SU;In Russian)

Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation
JINR rapid communications: Collection, 15:49745 (R;SU;In Russian)
Solution of eigenvalue problem for one class of hypersingular quasipotential integral equations, 15:50101 (R;SU;In Russian)

Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy
About a possibility to study the diffraction dissociation on the vertex detector spectrometer, 15:49306 (R;SU;In Russian)
An impact parameter analysis of antiproton-proton elastic and inelastic scattering at 22.4 GeV/c, 15:49950 (R;SU;In Russian)
JINR synchrophasotron: Operation and improvement (quarters 1,2,1988), 15:49229 (R;SU;In Russian)

Monitoring system for relativistic particles and nuclei, 15:49260 (R;SU)
Search for strangeness-abundant quark-gluon matter in nucleus-nucleus and antiproton-nucleus interactions, 15:50042 (R;SU;In Russian)
The high-energy neutron spectrometry in mixed indirectional radiation fields behind accelerator shielding, 15:49261 (R;SU)

Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics
Data acquisition system in CAMAC standard for multiparameter experiments, 15:49305 (R;SU;In Russian)
Muon spin relaxation study of protonic superionic conductor $CsHSO_4$, 15:50079 (R;SU)

Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems
Introduction of astatine into monoclonal antibodies, 15:49150 (R;SU;In Russian)
Polarization phenomena in reactions of deuteron stripping type, 15:50038 (R;SU)
Processing of the information from gamma detector at SIGMA-AJAX setup, 15:49307 (R;SU;In Russian)

Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions
Controllable changes in the porous structure of polymeric nuclear membranes, 15:48958 (R;SU)
Gas laser spectrometer for nuclear investigation at nucleonic stability limit. (project), 15:49308 (R;SU;In Russian)
Neutron-rich isotopes of the lightest elements, 15:49991 (R;SU)

Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics
Decays of η- and K_L-mesons into a lepton pair: three-dimensional theory and phenomenology, 15:49951 (R;SU;In Russian)
Description of low-lying vibrational $K^{\pi} \neq 0^+$ states of deformed nuclei in the quasiparticle-phonon nuclear model, 15:50041 (R;SU)
Electroweak radiative corrections to deep inelastic scattering at HERA. Charged current scattering, 15:49949 (R;SU)
Neutron-proton ratios of collective quadrupole matrix elements in even Fe and Cr isotopes, 15:50040 (R;SU)
On a generalization of the gauge principle at high energies, 15:49972 (R;SU;In Russian)
On the origin of the Schwinger anomaly, 15:49970 (R;SU)
Tensor lost in general relativity theory, 15:50100 (R;SU;In Russian)
The energy problem in GR and tensor analysis, 15:50099 (R;SU;In Russian)
The multiphonon version of the quasiparticle-phonon nuclear model: application to the problem of existence of low-lying two-phonon states in deformed nuclei, 15:50039 (R;SU)
Two new types of solvability of the one-dimensional anharmonic oscillators, 15:49971 (R;SU)

JP-International, Helsinki (Finland)
Development of an energy management system, 15:48831 (R;FI;In Finnish)

K

Kansas State Univ., Manhattan, KS (USA)
[Atomic physics with highly charged ions]: Progress report, FY 1990, 15:49873 (R;US)

Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto
An information system for 20 kV electricity distribution networks integrated to telecontrol and automation, 15:50236 (R;FI;In Finnish)

Kernforschungszentrum Karlsruhe GmbH (Germany, F.R.). Lab. fuer Isotopentechnik
On the removal of mercury from flue-gas scrub solutions by cementation, 15:48096 (R;DE)

KML Co., Munich (Germany, F.R.)
Report and recommendations regarding the environmental-assessment report for the proposed Point Aconi electrical generating station, 15:48099 (R;CA)
Technical committee for the long-range transport of atmospheric pollutants in western and northern Canada: Annual report, 1987, 15:49467 (R;CA)

KMS Fusion, Inc., Ann Arbor, MI (USA)
KMS Fusion Inc., 1989 semi-annual technical report, October 1988–March 1989, 15:50169 (R;US)

Knolls Atomic Power Lab., Schenectady, NY (USA)
Scaling of two-phase flow regimes in a rod bundle with freon, 15:48658 (R;US)

L

Laboratoire Central des Industries Electriques (LCIE), 92 - Fontenay-aux-Roses (France)
Resistance of solar modules to environment constraints, 15:48456 (R;FR;In French)

Lappeenrannan Teknillinen Korkeakoulu (Finland). Energiatekniikan Laitos
Calculation of transport and radiation properties of flue gases, 15:49463 (R;FI;In Finnish)
Power generation using a low power Organic Rankine Cycle, 15:48492 (R;FI;In Finnish)

Laurentian Univ., Sudbury, ON (Canada)
Determination of the levels of dinitropyrenes on diesel-exhaust particulate exhibiting excess mutagenic activity, 15:48123 (R;CA)

Laurentian Univ., Sudbury, ON (Canada). Dept. of Chemistry
The determination of the levels of dinitropyrenes on diesel exhaust particulate exhibiting excess mutagenic activity: Final report, 15:48841 (R;CA)

Lawrence Berkeley Lab., CA (USA)
Complex fragment emission in binary and multifragment decay of very hot nuclear systems, 15:50001 (R;US)
In-situ transmission electron microscopy and computer simulation study of the kinetics of oxygen loss in $YBa_2Cu_3O_z$, 15:48932 (R;US)
Integration of simulation into building design: The need for a joint approach, 15:48783 (R;US)
Least-cost planning for Pacific Gas and Electric: Stage 1: Load Management Strategy Testing Model (LMSTM) calibration, 15:48751 (R;US)
On the beam impedance of shallow tapered cavities, 15:49236 (R;US)
Program experience and its regulatory implications: A case study of utility lighting efficiency programs, 15:48784 (R;US)

Lawrence Livermore National Lab., CA (USA)
A continuum tensile failure model with friction, 15:49400 (R;US)
A hybrid pulse forming technique, 15:49220 (R;US)
A new site for the astrophysical gamma-process: Revision 1, 15:49836 (R;US)
Aluminum metal combustion in water revealed by high speed microphotography, 15:49395 (R;US)
An investigation of the critical facility tritium monitoring, 15:48373 (R;US)
Atomic physics of highly charged ions in an electron beam ion trap, 15:49895 (R;US)
Characterization of field errors of layer wound short solenoids, 15:49266 (R;US)
Compact representation of radiation patterns using spherical mode expansions: Final report, 15:49219 (R;US)
Description of a PC-based coupled "PER" theory/finite element method for calculating shaped charge jet characteristics, 15:49394 (R;US)
EE Microfabrication facility toxic gas system: A probabilistic risk assessment using human reliability analysis methods, 15:49731 (R;US)
High-resolution electron microscopy observations of athermal omega phase in Ti-Mo alloys, 15:48898 (R;US)
IGES efficiency evaluation, 15:50244 (R;US)
Integrated optical modulators for analog signal transmission, 15:49380 (R;US)
Modified-Yee field solutions in the AMOS wakefield code, 15:49237 (R;US)
MONT3E: A Monte Carlo electron heat transfer code, 15:50088 (R;US)
MRS role in reducing technical uncertainties in geological disposal, 15:48291 (R;US)

Multiple-energy techniques in industrial computerized tomography, 15:49318 (R;US)
Picosecond intensifier gating with a plated webbing cathode underlay, 15:49382 (R;US)
Public attitudes toward Lawrence Livermore National Laboratory: Summary of findings, 15:48701 (R;US)
Railgun performance with a two-stage light-gas gun injector: Revision 1, 15:49167 (R;US)
Respirator standards, regulations, and approvals in the USA, 15:49168 (R;US)
Risk of disclosure of sensitive information during warhead dismantlement, 15:48851 (R;US)
SISAL versus FORTRAN: A comparison using the Livermore Loops: Revision 2, 15:50242 (R;US)
Sub-nanosecond intensifier gating using heavy and mesh cathode underlays, 15:49381 (R;US)
The dynamics of magma transport and eruption processes: An overview of recent developments, 15:49743 (R;US)
Use of a FEL [free electron laser] as a buncher for a TBA [two-beam accelerator] scheme, 15:49238 (R;US)
Validating detection probabilities for the ASSESS [Analytic System and Software for Evaluating Safeguards and Security] insider database, 15:48395 (R;US)
What do you do when the network is 1 to 2 orders of magnitude faster than the backplane bus?, 15:50243 (R;US)
X-ray holography for sequencing DNA, 15:49652 (R;US)

Lehigh Univ., Bethlehem, PA (USA). Dept. of Chemistry
Chemical characterization of the surface sites of coal: Technical progress report, April–June 1990, 15:48085 (R;US)
Chemical characterization of the surface sites of coal: Technical progress report, April–June 1989, 15:48084 (R;US)

Letterman Army Inst. of Research, San Francisco, CA (USA)
Dermal penetration and systemic distribution of ^{14}C-labeled vitamin E human skin grafted athymic nude mice, 15:49656 (R;US)

Lexicon Project Committee, Fredericton, NB (Canada)
Glossary of lineman: English French, French-English, 15:48675 (R;CA)

Lockheed Missiles and Space Co., Palo Alto, CA (USA). Space Sciences Lab.
Viking data analysis. Final technical report, August 1986-March 1990, 15:49853 (R;US)

Los Alamos National Lab., NM (USA)
A clinical flow cytometry data analysis assistant, 15:49651 (R;US)
A Monte Carlo boundary propagation method for the solution of Poisson's equation, 15:50225 (R;US)
A vectorized heat transfer model for solid reactor cores, 15:48577 (R;US)
Accurate representations of general textures by a set of weighted grains, 15:48887 (R;US)
An apparatus for studies of hydrogen isotope exchange over metals using laser-Raman spectroscopy, 15:48998 (R;US)
Cross section and analyzing power for quasifree (p,n) reactions, 15:50000 (R;US)
Development of a small gantry robotic workcell for deoxyribonucleic acid (DNA) filter array construction, 15:49644 (R;US)
Discussion paper on environmental hazards on the Moon, in low Earth orbit, and in low Mars orbit, 15:49817 (R;US)
Fission-product chain yields and delayed neutrons: ANS 5.2 and ANS 5.8, 15:49994 (R;US)
Galileo light-weight radioisotope heater units design and safety analysis, 15:48408 (R;US)
General purpose nuclear data evaluations for ENDF/B-VI: Impact of cross-section standards, 15:49993 (R;US)
Implementation and assessment of the mechanical-threshold-stress model using the EPIC2 and PINON computer codes, 15:48886 (R;US)
International english, 15:50254 (R;US)
Isotope geochemistry: A critical component of energy research, 15:49739 (R;US)
Modeling issues associated with production reactor safety assessment, 15:48660 (R;US)
Monte Carlo next-event estimates from thermal collisions, 15:50060 (R;US)
Numerical models of 2-D and 3-D geophysical convection, 15:49740 (R;US)
Oscillation onset in neural delayed feedback, 15:49704 (R;US)
Performance evaluation of the IBM RISC [reduced instruction set computer] System/6000: Comparison of an optimized scalar processor with two vector processors, 15:50224 (R;US)
Preparation and properties of 3-amino-5-nitro-1,2,4-triazole, 15:49392 (R;US)
Random number stride in Monte Carlo calculations, 15:50103 (R;US)
Secondary-electron yield measurements from metals impacted by high- velocity ions, electrons, and molecules, 15:50084 (R;US)
Simulation of three-dimensional hydrodynamic components with a one-dimensional transient analysis code, 15:48659 (R;US)
Superconductor imaging surface magnetometry: Principles and applications, 15:49385 (R;US)
Transport, mixing and stretching in a chaotic Stokes flow: The two-roll mill, 15:49898 (R;US)
Yucca Mountain Project far-field sorption studies and data needs, 15:48284 (R;US)

Louisiana State Univ., Baton Rouge, LA (USA)
Measurement of the $e^+e^- \rightarrow b\bar{b}$ cross section and forward-backward charge asymmetry at a center-of-mass energy of 57.2 GeV, 15:49905 (R;US)

Louisiana State Univ., Baton Rouge, LA (USA). Dept. of Physics and Astronomy
Color flux distribution in pure SU(2) Lattice Gauge Theory, 15:49924 (R;US)

Louvain Univ., Louvain-la-Neuve (Belgium). Unite de Catalyse et Chimie des Materiaux Divises
Catalytic treatment of pyrolysis oils, 15:48435 (R;LU)

Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA)
Influence of experimental pulmonary emphysema on toxicological effects from inhaled nitrogen dioxide and diesel exhaust. Research report, January 1984-September 1987, 15:49721 (R;US)

Lyon-1 Univ., 69 (France)
Pion electroproduction near threshold on protons: how reaching the axial form factor of nucleon. Preparatory study of the experiment and pion spectrometer realization, 15:49906 (R;FR;In French)

M

Manitoba Public Utilities Board, Winnipeg, MB (Canada)
Manitoba Hydro application for an order requesting a general rate review and approval of certain rate adjustments effective April 1, 1990, 15:48753 (R;CA)
The [Manitoba] Public Utilities Board annual report, 1988, 15:48181 (R;CA)

Manitoba Recycling Action Committee, Winnipeg, MB (Canada)
Recycling: What you had to say. A summary of your comments at the open houses, 15:48830 (R;CA)

Maritime Electric Co. Ltd., Charlottetown, PE (Canada)
Maritime Electric Co. Ltd. annual report, 1989, 15:48752 (R;CA)

Maryland Dept. of Natural Resources, Annapolis, MD (USA). Power Plant and Environmental Review Div.
Environmental review of Potomac Electric Power Company's proposed Station H Element I, 15:48155 (R;US)

Maryland Univ., College Park, MD (USA). Dept. of Electrical Engineering
Mathematical models of hysteresis: Progress report, January 1990–December 1990, 15:50091 (R;US)

Massachusetts Inst. of Tech., Cambridge, MA (USA)
Transporting spent nuclear fuel: A framework for decision-making, 15:48232 (R;US)

Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Nuclear Engineering
A nodal method for the solution of the static, few-group diffusion equations in hexagonal geometry, 15:48593 (R;US)

Massachusetts Inst. of Tech., Lexington, MA (USA). Lincoln Lab.
Limits imposed by spatial hole burning on the single-mode operation of standing-wave laser cavities, 15:49202 (R;US)

Materials Engineering Associates, Inc., Lanham, MD (USA)
Proceedings of the third International Atomic Energy Agency specialist's meeting on subcritical crack growth: Opening session and Technical session 1, 15:48537 (R;US)
Proceedings of the third International Atomic Energy Agency specialists' meeting on subcritical crack growth: Technical sessions 2, 3, and 4 and Recommendations and conclusions Session 5, 15:48538 (R;US)

Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik
Limits on compositeness of quarks and leptons from e^+e^- annihilation, 15:49977 (R;DE)

McDonnell Douglas Research Labs., St. Louis, MO (USA)
Growth and deformation mechanisms of refractory-alloy hybrid materials. Final report, September 1986-September 1989, 15:48903 (R;US)

Michigan Univ., Ann Arbor, MI (USA). Dept. of Mechanical Engineering and Applied Mechanics
Injector and valve train friction studies: Cummins L-10 engine: Progress report, October 1, 1988–December 31, 1989, 15:48836 (R;US)

Minerals Management Service, New Orleans, LA (USA). Gulf of Mexico OCS Regional Office
Gulf of Mexico Sales 131, 135, and 137: Central, western and eastern planning areas: Final environmental impact statement: Volume 1, Sections I through IV.C, 15:48705 (R;US)
Gulf of Mexico sales 131, 135, and 137: Central, Western, and Eastern planning areas: Final environmental impact statement: Volume 2, Sections IV.D. and IX, 15:48154 (R;US)

Ministry of Agriculture, Fisheries and Food, London (UK)
Incorporation of experimental data, review and documentation of the SPADE database, 15:49711 (R;GB)

Mitsubishi Heavy Industries Ltd., Tokyo (Japan)
Development of the fuzzy control system for heat-pump air conditioners, 15:48791 (R;JP)

MK-Ferguson Co., Cleveland, OH (USA)
Proof of concept testing of the advanced NOXSO flue gas cleanup process: Quarterly technical progress report, April 1–June 30, 1990, 15:48512 (R;US)

Mobil Oil Canada, Calgary, AB (Canada)
Oil spill preparedness in the upstream petroleum industry, 15:48153 (R;CA)

Montana State Univ., Bozeman, MT (USA). Dept. of Mechanical Engineering
Corrosion and arc erosion in MHD channels: Quarterly progress report, January–March 1990, 15:48757 (R;US)

Montana Univ., Missoula, MT (USA). Wood Chemistry Lab.
Catalysis of carbon gasification: Influence of different modes of addition of catalysts. Annual report, January 1989-January 1990, 15:48081 (R;US)

N

Nagoya Univ. (Japan). Plasma Science Center
Conditions for ion reflection in a large-amplitude magnetosonic wave, 15:50165 (R;JP)
High-energy protons produced by a large-amplitude magnetosonic wave and associated gamma radiation through neutral pion decay, 15:49825 (R;JP)

National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center
Combustor design and analysis using the Rocket Combustor Interactive Design (ROCCID) methodology, 15:49193 (R;US)
Fuel-rich catalytic combustion: A fuel processor for high-speed propulsion, 15:49156 (R;US)
Influence of interfacial shear strength on the mechanical properties of SiC fiber reinforced reaction-bonded silicon nitride matrix composites, 15:48969 (R;US)
Introducing the VRT gas turbine combustor, 15:49192 (R;US)
New directions in InP solar cell research, 15:48459 (R;US)
Preliminary designs for 25 kWe advanced Stirling conversion systems for dish electric applications, 15:48469 (R;US)
Stress versus temperature dependent activation energies in creep, 15:48852 (R;US)
Theory and experimental technique for nondestructive evaluation of ceramic composites, 15:48967 (R;US)

National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center
Diode laser satellite systems for beamed power transmission, 15:48467 (R;US)
Improved model for solar cosmic ray exposure in manned Earth orbital flights, 15:49716 (R;US)
National Educators' workshop: Update 1989 standard experiments in engineering materials science and technology, 15:48853 (R;US)

National Aerospace Lab., Chofu, Tokyo (Japan)
Research and development of advanced gas turbine. Technical report, 15:48495 (R;JP)

National Board for Spent Nuclear Fuel, Stockholm (Sweden)
Views on the calculation of flow and dispersion processes in fractured rock, 15:48290 (R;SE)

National Board of Waters and the Environment, Helsinki (Finland)
Pollution load on the gulf of Finland in 1982-1984, 15:49636 (R;FI)

National Center for Atmospheric Research, Boulder, CO (USA)
Biological sources and sinks of methane in tropical habitats and tropical atmospheric chemistry. Doctoral thesis, 15:49532 (R;US)

National Coastal Ecosystems Team, Washington, DC (USA)
Ecological characterization atlas of coastal Alabama: Map narrative, 15:49571 (R;US)
Texas Barrier Islands Region ecological characterization atlas: Socioeconomic and natural features narrative, 15:49569 (R;US)
Texas Barrier Islands Region ecological characterization atlas: Biological resources narrative, 15:49570 (R;US)

National Energy Board, Ottawa, ON (Canada)
Reasons for decision [in the matter of a] rewiew of the applications for gas export licences from Direct Energy Marketing Limited, Indeck Gas Supply Corporation, Shell Canada Limited and Western Gas Marketing Limited as agent for TransCanada PipeLines Limited, 15:48187 (R;CA)
Reasons for decision [in the matter of a] rewiew of the applications for gas export licences from Direct Energy Marketing Limited, Indeck Gas Supply Corporation, Shell Canada Limited and Western Gas Marketing Limited as agent for TransCanada PipeLines Limited, 15:48188 (R;CA)

National Inst. for Fusion Science, Nagoya (Japan)
Adiabatic invariant and evaluation of particle loss in helical torus, 15:50180 (R;JP)
An empirical scaling of the thermal diffusivity applicable to both L- and H-mode discharges, 15:50164 (R;JP)
Current bubble formation by nonlinear coupling of resistive tearing modes, 15:50163 (R;JP)
Data compilation of angular distributions of sputtered atoms, 15:50087 (R;JP)
Effect of confinement of SoL plasma on core temperature profile, 15:50161 (R;JP)
Loss cone region in toroidal helical systems, 15:50181 (R;JP)
Plasma diagnostics and atomic processes, 15:50162 (R;JP)

National Inst. of Radiological Sciences, Chiba (Japan)
Annual report of National Institute of Radiological Sciences, April 1986 - March 1987, 15:50204 (R;JP)
Annual report of National Institute of Radiological Sciences, April 1987 - March 1988, 15:50205 (R;JP)
Annual report of National Institute of Radiological Sciences of the fiscal year 1987, 15:50206 (R;JP;In Japanese)
Radioactivity survey data in Japan, part 1: Environmental materials, 15:49603 (R;JP)
Radioactivity survey data in Japan, part 2: Dietary materials, 15:49705 (R;JP)

National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)
Photon Factory activity report, 1989, 15:50203 (R;JP)

National Power, Leatherhead (UK)
Analysis of PWR auxiliary coolant: determination of chloride in borax/nitrite solution by known addition - known dilution potentiometry, 15:48545 (R;GB)

Determination of boron as boric acid by automatic potentiometric titration using Gran plots [in pressurized water reactor coolant], 15:48993 (R;GB)

National Research Council of Canada, Ottawa, ON (Canada)
Genetics and the unity of biology: Proceedings: Part 1 of 2, 15:49653 (R;CA)
Genetics and the unity of biology: Proceedings: Part 2 of 2, 15:49654 (R;CA)

National Research Council, Washington, DC (USA). Committee on Nuclear Engineering Education
US Nuclear Engineering Education: Status and prospects, 15:48835 (R;US)

Nauchno-issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)
Local facility control organization in distributed automated control systems of technological parameters, 15:48610 (R;SU;In Russian)

Naval Ocean Systems Center, San Diego, CA (USA)
Superconcurrent processing: A dynamic approach to heterogeneous parallelism. Final report, 15:50210 (R;US)

Naval Research Lab., Washington, DC (USA)
Review of free-electron lasers, 15:49216 (R;US)

Naval Surface Warfare Center, Silver Spring, MD (USA)
Experimental study of the plasma-focus device as a charged-particle accelerator. Final report, October 1982-May 1985, 15:49223 (R;US)
Fabrication of composite high temperature superconductor wires from $Ag/YBa_2Cu_3O_x$ power produced by $AgNO_3$ decomposition, 15:48901 (R;US)

Nevada Univ., Reno, NV (USA). Water Resources Center
Red Canyon wash infiltration studies, 15:49592 (R;US)

New Brunswick Dept. of Natural Resources and Energy, Fredericton, NB (Canada)
Background discussion document on energy in New Brunswick, 1990-2000, 15:48744 (R;CA)

New Brunswick Dept. of Natural Resources and Energy, Fredericton, NB (Canada). Minerals and Energy Div.
Geology of the Stoney Creek oil and gas field, and its implications regarding the tectonic evolution of the eastern Moncton subbasin, New Brunswick. Geoscience report No. 89-1, 15:48130 (R;CA)
Testing of New Brunswick oil shale in R.P.C. test facility. Open File Report No. 90-2, 15:48199 (R;CA)

New Brunswick Dept. of Natural Resources and Energy, NB (USA)
Background discussion document on energy in New Brunswick, 1990-2000, 15:48745 (R;CA)

New Brunswick Dept. of the Environment, Fredericton, NB (Canada)
Guidelines for an environmental impact assessment of the second New England intertie 345 kV transmission line, 15:48681 (R;CA)
Guidelines for an environmental impact assessment of a 345 kV transmission line from Salisbury to Bathurst/Belledune, 15:48682 (R;CA)

New Brunswick Electric Power Commission, Fredericton, NB (Canada)
Draft guidelines for an environmental impact assessment: N.B. Power, Millbank Generating Station, 15:48151 (R;CA)
Guidelines for an environmental impact assessment of the second New England intertie 345-kV transmission line, 15:48679 (R;CA)
Guidelines for an environmental impact assessment of a 345-kV transmission line from Salisbury to Bathurst/Belledune, 15:48680 (R;CA)

New Energy Development Organization, Tokyo (Japan)
Co-researches with researchers of alternative energy of petroleum in EC countries, 15:48730 (R;JP;In Japanese)
Interchange of researchers on alternative energy of petroleum in EC countries, 15:48732 (R;JP;In Japanese)
Invitation business of experts in alternative energy, 15:48731 (R;JP;In Japanese)
Report on the preparatory investigation of the Pacific energy information network system, 15:48741 (R;JP;In Japanese)
Study on feasible applications of stirling cycle machine, 15:48837 (R;JP;In Japanese)
Survey for impacts of global environmental issues on utilizations of alternative energies for oil, 15:49469 (R;JP;In Japanese)
Survey on solidification and utilization technology of CO_2, 15:49468 (R;JP;In Japanese)

New Hampshire Dept. of Health and Human Services, Concord, NH (USA). Environmental Health Risk Assessment Unit
Health assessment for Fletcher's Paint Works and Storage Facility Hazardous Waste Material, Milford, Hillsborough County, New Hampshire, Region 1. CERCLIS No. NHD981067614. Preliminary report, 15:49615 (R;US)
Health assessment for South Municipal Water Supply Well, Hillsborough County, Peterborough, Cheshire County, New Hampshire, Region 1. CERCLIS No. NHD980671069. Final report, 15:49616 (R;US)

New Hampshire Univ., Durham, NH (USA)
Radon-removal techniques for small community public water supplies, 15:49633 (R;US)

New Jersey Dept. of Environmental Protection, Trenton, NJ (USA)
Health assessment for Radiation Technology, Inc., Rockaway, Morris County, New Jersey, Region 2. CERCLIS No. NJD047684451. Final report, 15:49625 (R;US)

New Jersey Dept. of Environmental Protection, Trenton, NJ (USA). Div. of Science and Research
Health assessment for Landfill and Development Company, Mount Holly, New Jersey, Region 2. CERCLIS No. NJD048044325. Final report, 15:49611 (R;US)

New Jersey State Dept. of Health, Trenton, NJ (USA)
Health assessment for Cinnaminson Township (Block 702) Ground-Water Contamination, Cinnaminson, Burlington County, New Jersey, Region 2. CERCLIS No. NJD980785638. Final report, 15:49621 (R;US)
Health assessment for Ewan Property, Shamong Township, Burlington County, New Jersey, Region 2. CERCLIS No. NJD980761365. Final report, 15:49626 (R;US)
Health assessment for Imperial Oil Co., Inc./Champion Chemicals, Marlboro Township, Monmouth County, New Jersey, Region 2. CERCLIS No. NJD980654099. Final report, 15:49624 (R;US)

New Mexico Univ., Albuquerque, NM (USA). School of Medicine
Nitrogen dioxide and respiratory infection: Pilot investigations. Research report, January 1984-September 1987, 15:49536 (R;US)

Nolan, Davis and Associates Ltd., St. John's, NF (Canada)
A study of asphaltene flocculation in heavy oil and asphalt solutions: Final report, 15:48174 (R;CA)

North Atlantic Treaty Organization, Brussels (Belgium). Committee on the Challenges of Modern Society
Pilot study on international information exchange on dioxins and related compounds. Final report, 1985-1989, 15:49723 (R;BE)

Northwestern Univ., Chicago, IL (USA)
Intramolecular electron transfer rates: Three year progress report, 15:49124 (R;US)

Nottingham Univ. (UK)
Short-fibre and particulate-reinforced metal-matrix composites, 15:48907 (R;US)

Nova Husky Research Corp. Ltd. (Canada)
Bacterial evaluation of the biopolymer selective plugging field test at Standard Hill, Saskatchewan, 15:48132 (R;CA)

Nova Scotia Dept. of Mines and Energy, Halifax, NS (Canada)
Nova Scotia oil and gas report, 1986, 15:48748 (R;CA)

Nova Scotia Power Corp., Halifax, NS (Canada)
Nova Scotia Power Corporation. Sixty-ninth annual report, 1988/1989, 15:48518 (R;CA)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering
Crack-arrest behavior in SEN wide plates of low-upper-shelf base metal tested under nonisothermal conditions: WP-2 series, 15:48608 (R;US)
Proceedings of the third International Atomic Energy Agency specialist's meeting on subcritical crack growth: Opening session and Technical session 1, 15:48537 (R;US)
Proceedings of the third International Atomic Energy Agency specialists' meeting on subcritical crack growth: Technical sessions 2, 3, and 4 and Recommendations and conclusions Session 5, 15:48538 (R;US)
Recommendations for the shallow-crack fracture toughness testing task within the HSST [Heavy-Section Steel Technology] Program, 15:48571 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services
Nuclear regulatory commission issuances, 15:48590 (R;US)
Regulatory and technical reports (abstract index journal): Second quarter, April–June 1990, 15:48588 (R;US)
Title List of Documents Made Publicly Available, July 1–31, 1990, 15:48589 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution
Quantitative analysis of potential performance improvements for the dry PWR [pressurized water reactor] containment, 15:48667 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research
Bias in peak clad temperature predictions due to uncertainties in modeling of ECC bypass and dissolved non-condensable gas phenomena, 15:48664 (R;US)
Multiloop Integral System Test (MIST): Final report: MIST phase 4 tests: Volume 11, 15:48665 (R;US)
Multiloop Integral System Test (MIST): Final report: MIST Phase 4 tests, 15:48666 (R;US)
Radionuclide release calculations for selected severe accident scenarios: Supplemental calculations, 15:48663 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Technology
Overview and comparison of US commercial nuclear power plants: Nuclear power plant system sourcebook, 15:48539 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data
Licensee Event Report (LER) compilation for month of August 1990: Volume 9, No. 8, 15:48592 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office of Enforcement
Enforcement actions: Significant actions resolved: Quarterly progress report, April–June 1990, 15:48591 (R;US)

O

Oak Ridge Associated Universities, Inc., TN (USA)
Contribution of Anticipated Transients Without Scram (ATWS) to core melt at United States nuclear power plants, 15:48647 (R;US)

Oak Ridge Gaseous Diffusion Plant, TN (USA)
Gas-phase chemical reactivity of CFC-114 [Chloro-fluoro-carbons-114] and potential replacements: Part 1, CFC-114 reactivity with Fsub 2 and UFsub 6, 15:48216 (R;US)
The linear solution for hydriding of uranium, 15:48883 (R;US)

Oak Ridge National Lab., TN (USA)
A unified framework for credit assignment, 15:50214 (R;US)
Advanced Neutron Source: The designer's perspective, 15:48404 (R;US)
Advanced Neutron Source: The users' perspective, 15:48403 (R;US)
Analysis and prediction of thermal properties of mesophases and crystals by calorimetry and supercomputers, 15:48953 (R;US)
Applications of diode lasers to resonance ionization mass spectrometry, 15:49870 (R;US)
Artificial intelligence for subject interviewing, 15:48699 (R;US)
Benchmarking of dose rate calculations for spent fuel transportation casks, 15:49160 (R;US)
Burnup credit feasibility for BWR spent fuel shipments, 15:48526 (R;US)
Calculation of BWR [Boiling Water Reactor] limit cycle amplitude using Galerkin's method, 15:48527 (R;US)
Collisional and electric-field ionization of laser-prepared Rydberg states in an ion trap mass spectrometer, 15:49872 (R;US)
Command validation of secondary EM [electro-magnetic] pump system in the EBR-II [Experimental Breeder Reactor-II], 15:48611 (R;US)
Commercial sector gas cooling technology frontier and market share analysis, 15:48771 (R;US)
Compositional imaging of semiconductor interfaces by Z-contrast scanning transmission electron microscope (STEM), 15:48952 (R;US)
Crack-arrest behavior in SEN wide plates of low-upper-shelf base metal tested under nonisothermal conditions: WP-2 series, 15:48608 (R;US)
Development of remote disassembly technology for liquid-metal reactor (LMR) fuel, 15:48579 (R;US)
Development of the Structural Materials Information Center, 15:48646 (R;US)
Edge turbulence and transport: Text and ATF modeling, 15:50112 (R;US)
End effects in the criticality analysis of burnup credit casks, 15:48230 (R;US)
Flaw assessment procedure for high temperature reactor components, 15:48580 (R;US)
High energy iron ion implantation into sapphire, 15:50069 (R;US)
Indentation testing of thin films and hard materials, 15:48912 (R;US)
Ion mixing of semiconductor superlattices, 15:48951 (R;US)
Irradiation creep of graphite, 15:48600 (R;US)
Large collective lamb shifts in high pressure noble gases, 15:49871 (R;US)
Laser applications for high-T_c superconductors, 15:49206 (R;US)
Licensee Event Report (LER) compilation for month of August 1990: Volume 9, No. 8, 15:48592 (R;US)
LQG/LTR control system design for a low-pressure feedwater heater train with time delay, 15:48612 (R;US)
Measurement of two-phase flow momentum with force transducers, 15:48645 (R;US)
Mechanical properties, fracture behavior, and grain-boundary chemistry of B-doped NiAl, 15:48867 (R;US)
Modeling histogram data with piecewise polynomials, 15:50237 (R;US)
Oceanic CO_2 uptake and future atmospheric CO_2 concentrations, 15:49589 (R;US)
On the adequacy of message-passing parallel supercomputers for solving neutron transport problems, 15:50053 (R;US)
Parallel performance models for the nodal transport method on the hypercube, 15:50213 (R;US)
Performances of four magnetic heat-pump cycles, 15:49161 (R;US)
Potential for advanced thermoplastic composites in space systems, 15:49405 (R;US)
Practical application of passive safety features for the advanced neutron source cooling system, 15:48642 (R;US)
Quality Assurance (QA) plan for the Airlift Deployment Analysis System (ADANS), 15:49391 (R;US)
Radiation protection of the public: Past, present, and future, 15:50063 (R;US)
Reactor critical benchmark calculations for burnup credit applications, 15:48231 (R;US)
Recommendations for the shallow-crack fracture toughness testing task within the HSST [Heavy-Section Steel Technology] Program, 15:48571 (R;US)
Resonance ionization spectroscopy of molecular clusters using picosecond lasers, 15:48992 (R;US)
Results of the radiological survey at the Granite City Steel faciltiy, Granite City, Illinois, 15:49575 (R;US)
Study of asymmetric supersonic jet flow for ejectors, 15:48805 (R;US)
Surface anharmonicity: Temperature dependence of phonon energies on Cu(110), 15:50068 (R;US)
The chemical state of iron ions implanted into silicon carbide, 15:48950 (R;US)
The effect of denaturation and reduction on cellobiohydrolase 1 from Trichoderma reesei, 15:49642 (R;US)
The photon scanning tunneling microscope, 15:49377 (R;US)
The search for advanced remote technology in fast reactor reprocessing, 15:48224 (R;US)
The stability of irradiation-induced defects in NiAl, 15:48864 (R;US)
Thermal performance analysis for heat exchangers using nonazeotropic refrigerant mixtures, 15:48772 (R;US)
Tubeside evaporation of nonazeotropic refrigerant mixtures from two enhanced surfaces, 15:48773 (R;US)
Updated comparison of economics of fusion reactors with advanced fission reactors, 15:50168 (R;US)
Validation of scale-4 for LWR [Light Water Reactor] fuel in transportation and storage cask conditions, 15:48229 (R;US)

X-ray microprobe-microscopy, 15:49187 (R;US)
[19th international conference on low-temperature physics]: Foreign trip report, August 15–25, 1990, 15:50089 (R;US)
[An experiment at GSI/SIS to study the 4π detector system]: Foreign trip report, June 9–September 5, 1990, 15:49316 (R;US)
[Chemical thermodynamics]: Foreign trip report, August 23, 1990–September 5, 1990, 15:49082 (R;US)
[Cross sections for lepton pair production and for capture of the pair-produced electrons to bound states of the fully-stripped projectiles]: Foreign trip report, July 18, 1990–August 31, 1990, 15:49917 (R;US)
[Defects in close-packed metals and alloys]: Foreign trip report, August 9, 1990–August 22, 1990, 15:48896 (R;US)
[DNA repair and mutagenesis]: Foreign trip report, July 23, 1990–August 25, 1990, 15:49645 (R;US)
[High-temperature reactor materials for gas-cooled reactor]: Foreign trip report, August 24, 1990–September 1, 1990, 15:48578 (R;US)
[International meeting of ecology]: Foreign trip report, August 20, 1990–August 30, 1990, 15:49574 (R;US)
[Mechanical behavior of ceramics and composites]: Foreign trip report, August 2, 1990–August 22, 1990, 15:48933 (R;US)
[Mobile robots and intelligent motion control]: Foreign trip report, August 18, 1990–August 25, 1990, 15:49163 (R;US)
[Modeling of ecosystems]: Foreign trip report, August 21, 1990–September 4, 1990, 15:49412 (R;US)
[New techniques and design approaches of neutron scattering facilities]: Foreign trip report, July 1, 1990–July 30, 1990, 15:48407 (R;US)
[Reactor dosimetry]: Foreign trip report, August 24, 1990–September 4, 1990, 15:48668 (R;US)

Oak Ridge Y-12 Plant, TN (USA)
A process monitoring strategy for a Precision Flexible Manufacturing System, 15:49169 (R;US)
An automated linearity test for direct voltage calibrators, 15:49386 (R;US)

Office National d'Etudes et de Recherches Aerospatiales (ONERA), 92 - Chatillon (France)
Dynamic test of a 9m diameter wind turbine, 15:48480 (R;FR;In French)
Putting into service the RFO wind turbine at the CNEEL, 15:48481 (R;FR;In French)

Office of Naval Material, Washington, DC (USA)
Analysis of soil samples for chemical warfare agents: Canadian contribution to a multinational round-robin analytical exercise. Memorandum report, 15:49409 (R;US)

Office of Technology Assessment (U.S. Congress), Washington, DC (USA)
Energy use and the US economy. Background paper, 15:48700 (R;US)
Physical vulnerability of electric systems to natural disasters and sabotage, 15:48517 (R;US)

Old Dominion Univ., Norfolk, VA (USA). Dept. of Physics
SDIO/1st ultrashort wavelength laser - novel experimental schemes for observing the Moessbauer Effect in long-lived nuclear levels and nuclear coherent states. Final technical report for period ending 26 May 1990, 15:49200 (R;US)

OMNI Environmental Services, Inc., Beaverton, OR (USA)
Accelerated sample processing 1988-89. Phase 3, Northeast Cooperative Woodstove study: Final report, 15:48441 (R;CA)

Ontario Hydro, Toronto, ON (Canada). Research Div.
A data acquisition system for residential magnetic field source characterization, 15:48453 (R;CA)
A statistical comparison of uplift design methods for augered footings in sand, 15:48970 (R;CA)
A study of Ontario Hydro's contribution to ozone levels in Ontario: Phase 1: Literature review, 15:48450 (R;CA)
Assessment of the iron-based, stressed-shell container, 15:48286 (R;CA)
Atikokan TGS aquatic studies, 1981 to 1988, II: Water chemistry, 15:48516 (R;CA)
Atmospheric corrosion of transmission line conductors: Literature review, 15:48676 (R;CA)
Canada Brick Quarry ash landfill. Groundwater monitoring and control system modifications, 1989, 15:49604 (R;CA)
Canada Brick Quarry Ground Water Survey 8th annual report, 1988-1989, 15:49605 (R;CA)
Exposure system for animal studies involving high-level 60-Hz magnetic fields, 15:49729 (R;CA)
Infrasonic enhancement of heat transfer: Preliminary report, 15:49186 (R;CA)
Measurement of biogenic and anthropogenic volatile organic compounds during the Canadian atmospheric chemistry study, July 17 to August 31, 1988, 15:49466 (R;CA)
Measurement of biogenic and anthropogenic volatile organic compounds during the Canadian Atmospheric Study, July 17 to August 31, 1988, 15:49472 (R;CA)
Metallurgical investigation of main-steam-line weldment cracking, Lakeview TGS, 15:48493 (R;CA)
Metallurgical investigation of main steam line weldment cracking, Lakeview TGS [thermal generating station], 15:48494 (R;CA)
Method of measuring Cf_3T activity developed for laser-based tritium separation, 15:48399 (R;CA)
Operational testing of two thermal energy storge furnaces, 15:48689 (R;CA)
Prediction of the environmental fate of pentachlorophenol as a function of pH using fugacity models, 15:49573 (R;CA)
Reactor operating waste-disposal program: 1989 progress report, 15:48285 (R;CA)
Robotic inspection of prototype titanium diffusion-bond final-closure weld: Final report, 15:48235 (R;CA)
Scale-model simulation of impact of a rail-locomotive coupler on the irradiated-fuel transportation cask, 15:48234 (R;CA)
The role of clouds and precipitation in the long-range transport of air pollutants and acid rain formation in Canada: Phase 2. Programming, testing and refining of cloud dynamics, microphysics and chemistry models, 15:49473 (R;CA)
The use of cover crops for the maintenance of rights-of-way vegetation: A survey of the literature on succession, cover crops competition and trees, 15:48677 (R;CA)
Thermal instability of underground power cables, 15:48678 (R;CA)
Thermal performance and delivery capability of an electric water heater with a non-pressurized plastic tank, 15:48786 (R;CA)
Third isotope separation workshop, 15:48400 (R;CA)
Trip report: International Congress on Applications of Lasers and Electro-Optics, Oct. 16-19, 1989, Orlando, Florida, 15:48895 (R;CA)
Wind force measurement on a model fuelling-machine trolley in a simulated LOCA, 15:48661 (R;CA)

Ontario Ministry of Agriculture and Food, Delhi, ON (Canada). Agricultural Energy Centre
A study of the impact of no-till on tractor fuel cost vs crop returns, as affected by various no-till planter modifications, 15:48819 (R;CA)
Biomass fuels proven dependable at work on Ontario farms, 15:48816 (R;CA)
Energy efficient lighting options, 15:48790 (R;CA)
Evaluation of dehumidifiers in a rose greenhouse, 15:48789 (R;CA)
Handling and curing peanuts in modified tobacco bins, 15:48822 (R;CA)
Heat exchangers reduce costs, provide better livestock environment, 15:48815 (R;CA)
Heat pumps gain popularity solving more farm needs, 15:48814 (R;CA)
Insulation cuts curing costs, offers better kiln control, 15:48817 (R;CA)
Irrigation pumping plant evaluation: Interim report, 15:48820 (R;CA)
Methods to utilize tobacco kilns for curing (drying) and/or storage of alternate crops: Interim report. 1988 year, 15:48821 (R;CA)
Partial room brooding for poultry, 15:48788 (R;CA)
Reduce grain drying costs by recovering lost heat, 15:48813 (R;CA)
Sealing and insulating specific areas of bulk tobacco kilns: Final report, 15:48812 (R;CA)
Versatility of tobacco kilns eases shift to alternate crops, 15:48818 (R;CA)

Ontario Ministry of Agriculture and Food, Toronto, ON (Canada)
Growth room temperature control with water-source heat pumps, 15:48787 (R;CA)

Ontario Ministry of the Environment, Toronto, ON (Canada). Corporate Resources Div.
Monitoring costs and their implications for direct dischargers in the Ontario mineral industry: Group B, industrial minerals sector, 15:49601 (R;CA)

Ontario Ministry of the Environment, Toronto, ON (Canada). Research and Technology Branch
Proceedings [of the] Environmental research: Technology transfer conference: Volume 2. Liquid and solid waste, analytical methods, environmental socio-economics, 15:48733 (R;CA)

Ontario Ministry of Transportation, Downsview, ON (Canada). Engineering Materials Office
Canadian developments in testing concrete aggregates for alkali-aggregate reactivity, 15:48955 (R;CA)

Ontario Waste Management Corporation, Toronto, ON (Canada)
Report of the PCB Working Group, 15:49576 (R;CA)

Oregon State Univ., Corvallis, OR (USA). Coll. of Oceanography
New approaches to estimation of magnetotelluric parameters: Annual report, 1 August 1989–31 July 1990, 15:49732 (R;US)

Oslo Univ. (Norway). Fysisk Inst.
Section for nuclear physics and energy physics - Annual report 1989: January 1 - December 31, 1989, 15:50207 (R;NO)

Ottawa Univ., ON (Canada). Electrochemical Science and Technology Centre
Electrical power sources inventory for Transport Canada, 15:48755 (R;CA)

Oulu Univ. (Finland)
International risk factors affecting Finnish energy supplies, 15:48742 (R;FI;In Finnish)

Oxford Institute for Energy Studies (UK)
An econometric analysis of exploration and extraction of oil on the U.K. continental shelf, 15:48142 (R;GB)

P

Pacific Northwest Lab., Richland, WA (USA)
Chemical data bases for the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1, 15:49151 (R;US)
Classification of acoustic emission waveforms for nondestructive evaluation using neural networks, 15:50239 (R;US)
Combined capillary electrophoresis and electrospray ionization mass spectrometry, 15:49025 (R;US)
Comparison of ELCAP data with lighting and equipment load levels and profiles assumed in regional models, 15:48794 (R;US)
Electric utility benefits of superconducting magnetic energy storage, 15:48497 (R;US)
Frequency profiles of residential wood burning for the northwestern United States, 15:48442 (R;US)
Hanford Environmental Dose Reconstruction Project: Monthly report, August 1990, 15:49546 (R;US)
Japanese power electronics inverter technology and its impact on the American air conditioning industry, 15:48793 (R;US)
Managing technical information in a multi-contractor environment, 15:50255 (R;US)
Multimedia Environmental Pollutant Assessment System (MEPAS) application guidance: Volume 1, User's guide, 15:49548 (R;US)
Multimedia Environmental Pollutant Assessment System (MEPAS) application guidance: Volume 2, Guidelines for evaluating MEPAS input parameters, 15:49583 (R;US)
Planning for future waste storage and transport requirements, 15:48825 (R;US)
Predicted drainage at a semiarid site: Sensitivity to hydraulic property description and vapor flow, 15:48287 (R;US)
Results from a workshop on research needs for modeling aquifer thermal energy storage systems, 15:48690 (R;US)
Soil erosion rates from mixed soil and gravel surfaces in a wind tunnel, 15:49584 (R;US)
Supplemental mathematical formulations: The Multimedia Environmental Pollutant Assessment System (MEPAS), 15:49547 (R;US)
The ecology of elk in an arid environment: An overview of the Hanford elk project, 15:49640 (R;US)
The practical challenges of converting end-use data into information, 15:48795 (R;US)
The role of elf field dosimetry and bioeffects mechanisms in relating in vitro to in vivo exposures, 15:49730 (R;US)
Theoretical calculations of the nonlinear dielectric function of inhomogeneous thin films, 15:48972 (R;US)
Thermal energy storage for integrated gasification combined-cycle power plants, 15:48496 (R;US)
Upgrading user interfaces to computational chemistry codes, 15:48987 (R;US)
Well network and measurement schedules for monitoring water-level changes beneath the separations area of the Hanford Site, 15:49741 (R;US)

Pacific-Sierra Research Corp., Los Angeles, CA (USA)
Effects of ionizing radiation on the performance of selected tactical combat crews. Technical report, 12 March 1986-30 October 1987, 15:49708 (R;US)

Paris-11 Univ., 91 - Orsay (France)
Charged pion production in nucleus-nucleus collisions at E/A between 400 and 800 mev, 15:50007 (R;FR;In French)
Charged pion production in nucleus-nucleus collisions AT E/A between 400 and 800 MeV, 15:49982 (R;FR;In French)
The transverse displacement in a circular accelerator disturbs the hexapolar non-linearities. Application to the dynamical aperture problem, 15:49232 (R;FR;In French)

Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire
Experiments on neutron-rich light nuclei at Ganil, 15:49995 (R;FR)
Laser spectroscopy of laser-desorbed gold isotopes, 15:50073 (R;FR)

Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire
Study of neutrino oscillations in the frejus experiment, 15:49915 (R;FR)

Paul Scherrer Inst. (PSI), Villigen (Switzerland)
Iodine chemistry and transport calculations for the radioiodine test facility experiments (ACE-RTF) using the MITIMAKS code and the LIRIC data base, 15:49152 (R;CH)

PEI Associates, Inc., Cincinnati, OH (USA)
Air/Superfund national technical guidance study series. Development of example procedures for evaluating the air impacts of soil excavation associated with Superfund remedial actions. Final report, 15:49544 (R;US)
Guide for conducting treatability studies under CERCLA. Interim report (Final), 15:48713 (R;US)

Pennsylvania State Univ., University Park, PA (USA). Graduate School
Magnetohydrodynamic modification of the TEACH-T code and the prediction of the maximum azimuthal velocity in a conducting fluid, 15:49896 (R;US)

Petroleum Monitoring Agency, Ottawa, ON (Canada)
Canadian petroleum industry: 1989 monitoring report. First six months, 15:48143 (R;CA)

Philadelphia Coll. of Pharmacy and Science, PA (USA). Dept. of Chemistry
High-pulse-energy flashlamp pumpable laser dyes. Interim technical report, 1 October 1989-31 March 1990, 15:49204 (R;US)

Physical Optics Corp., Torrance, CA (USA)
Holographic rugate structures for x-ray optics applications: Phase 2 Annual report, 15:49153 (R;US)

PRC Environmental Management, Inc., McLean, VA (USA)
Superfund innovative technology evaluation program: Technology profiles, November 1989, 15:48712 (R;US)

Public Service Co. of Indiana, Inc., Plainfield, IN (USA)
Geothermal ground-loop preinstallation project at Walden Pond: Final report, 15:48780 (R;US)

Purdue Univ., Lafayette, IN (USA). Dept. of Chemistry
Dynamical solvent effects on electron-transfer processes: Recent progress and perspectives. Technical report, 15:49030 (R;US)
Ionic atmosphere effects on the energetics of thermal and optical electron-exchange reactions: Application to ferrocenium-ferrocene self exchange. Technical report, 15:49031 (R;US)

Q

Quebec Ministere de l'Energie et des Ressources, PQ (Canada). Bureau de l'Efficacite Energetique
Evaluation of the energy consumption of the public sector in Quebec, 1985-1986, 15:48743 (R;CA)

Quebec Ministere de l'Environnement, Ste-Foy, PQ (Canada)
Impact of acidification on the economic value of recreational fishing in eastern Canada. Economic and Commercial Analysis Report No. 14, 15:49600 (R;CA)

Quebec Ministere du Loisir, de la Chasse et de la Peche, PQ (Canada). Service de l'Amenagement et de l'Exploitation de la Faune
Determination of the acid level of weakly mineralized waters, 15:49634 (R;CA)

R

R and D Associates, Marina del Rey, CA (USA)
Updated excitation and ionization cross sections for electron impact on atomic oxygen. Quarterly report, 15:49891 (R;US)

Radian Corp., Austin, TX (USA)
Flue gas desulfurization (FGD) chemistry and analytical methods handbook: Volume 1, Process chemistry - Sampling, measurement, laboratory and process performance guidelines (Revision 1): Final report, 15:48514 (R;US)

Radian Corp., Research Triangle Park, NC (USA)
Evaluation of emission factors for formaldehyde from certain wood processing operations. Final report, May-August 1989, 15:49543 (R;US)

Radiation Effects Research Foundation, Hiroshima (Japan)
Frequency of malignant tumors during the first two decades of life in the offspring (F_1) of atomic bomb survivors, 15:49717 (R;JP)

Radiation Protection Service, Fredericton, NB (Canada)
Indoor air quality in New Brunswick homes: Radon and radon daughters, 15:49464 (R;CA)

Research Triangle Inst., Durham, NC (USA)
Measurements of exhaled breath using a new portable sampling method, 15:49538 (R;US)

Resource Dynamics Corp., Vienna, VA (USA)
Cogeneration and independent power production: Market insight and outlook: Final report, 15:48750 (R;US)

Ridgetown Coll. of Agricultural Technology, ON (Canada)
Growth room temperature control with water-source heat pumps, 15:48787 (R;CA)

Rijksinstituut voor Volksgezondheid en Milieuhygiene, Bilthoven (Netherlands)
Appendix to Report No. 758474011. Integrated criteria document PAH: Republication of Addendum to Report No. 758474007, March 1989. Effects of 10 selected compounds, 15:49725 (R;NL)
In-situ biorestoration of a subsoil contaminated with gasoline. Interim report, 15:48156 (R;NL)
Integrated criteria document: Asbestos effects, 15:49537 (R;NL)
Integrated criteria document: Asbestos effects. Appendix, 15:49722 (R;NL)
Integrated criteria document: PAHs, 15:49724 (R;NL)

RM Consultants, Abingdon (UK)
VANDAL technical overview: VANDAL version 1.1, 15:48267 (R;GB)

RMA Aerospace, Inc., Mountain View, CA (USA)
Development of a comprehensive magnetohydrodynamic model of solar-terrestrial interaction. Final report, 1 March 1986-30 September 1988, 15:49854 (R;US)

Royal Norwegian Council for Scientific and Industrial Research, Kjeller (Norway)
Stability of RMS Lg measurements and their potential for accurate estimation of the yields of Soviet underground nuclear explosions. Technical report, November 1989-31 January 1990, 15:49402 (R;NO)

Rutherford Appleton Lab., Chilton (UK)
Amplitude analysis of $\gamma\gamma \rightarrow \pi\pi$ from threshold to 1.4 GeV, 15:49957 (R;GB)
Muon spin relaxation study of protonic superionic conductor $CsHSO_4$, 15:50079 (R;SU)
Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989, 15:50182 (R;GB)

S

S-Cubed, San Diego, CA (USA)
Regional discrimination of quarry blasts, earthquakes and underground nuclear explosions. Final report, 23 March 1987-22 March 1989, 15:49403 (R;US)

Sairaalalitto, Helsinki (Finland)
Energy conservation and hospital hygiene, 15:48785 (R;FI;In Finnish)

San Jose State Univ., CA (USA)
Thin-film composite materials, Phase 2. Final report, 1 April-31 December 1986, 15:48948 (R;US)

Sandia National Labs., Albuquerque, NM (USA)
A Nuisance Alarm Data System for evaluation of intrusion detectors, 15:49379 (R;US)
A numerical study of convection in a layered porous medium heated from below, 15:48478 (R;US)
A program to qualify ductile cast iron for use as a containment material for Type B transport cask, 15:49165 (R;US)
A radiation hardened SONOS/CMOS EEPROM family, 15:49367 (R;US)
An adaptive finite element technique using element equilibrium and paving, 15:50241 (R;US)
An expert system for automated robotic grasping, 15:49164 (R;US)
An infrared imaging area sensor for tactical and physical security applications, 15:48394 (R;US)
Bench-scale testing of a heat-pipe receiver for solar thermal electric applications, 15:48470 (R;US)
Computer modeling of 12-inch actuator shock test performance, 15:49190 (R;US)
Development and test case application of a waste minimization project evaluation method, 15:48726 (R;US)
Development of hermetic microminiature connectors, 15:49217 (R;US)
Electric-field dependent electroreflectance and photocurrent spectroscopy in InGaAs/InAlAs strained-layer superlattices, 15:48974 (R;US)
Evolution of surface area during the controlled growth of silica spheres, 15:48973 (R;US)
Formation and stability of As-H bonds in H-implanted GaAs, 15:49083 (R;US)
Generic quality assurance/quality control guide for photovoltaic concentrator design, development and system installation, 15:48460 (R;US)
Implementation of a QML (Qualified Manufacturer's List) methodology for discrete semiconductors, 15:48977 (R;US)
Improved tracking for bilateral teleoperators with time delay, 15:49166 (R;US)
Intense ion beam transport in neutral gas, 15:50202 (R;US)
Light-heavy-hole-mixing-induced selection rules for magnetoluminescence and valence-band energy dispersion in semiconductor quantum wells, 15:49892 (R;US)
Nonparabolic conduction bands and masses in strained-single-quantum wells, 15:48975 (R;US)
Optical characterization of CdZnTe/CdTe strained quantum wells, 15:48978 (R;US)
Photoluminescence studies of $In_xGa_{1-x}As/Al_yGa_{1-y}As$ strained-layer structures: Effects of annealing, 15:48976 (R;US)
Preliminary model of repository chemistry for the Waste Isolation Pilot Plant, 15:48288 (R;US)
Recent field trials of directional boring equipment for emplacing a borehole grid around and beneath a simulated waste site, 15:49742 (R;US)
Reference concepts for a space-based hydrogen-oxygen combustion, turboalternator, burst power system, 15:49406 (R;US)
Short and long loop manufacturing feedback using a multi-sensor assembly test chip, 15:49191 (R;US)

SICADS: Site Independent Configurable Alarm Display System, 15:50240 (R;US)
Solderability of environmentally exposed Sn-plated surfaces, 15:48897 (R;US)
Stochastic electron beams in the ion-focused regime, 15:49893 (R;US)
Stress accommodation in large-mismatch systems, 15:48979 (R;US)
Terrestrial nickel/hydrogen battery evaluation, 15:48468 (R;US)
Tethered rocket as a vehicle for penetration and impact testing: Development report, 15:49393 (R;US)
Thermal neutron absorption cross sections for igneous rocks: Newberry Caldera, Oregon, 15:48479 (R;US)
Thermal stresses in layered electrical assemblies bonded with solder, 15:49218 (R;US)

Sao Paulo Univ., SP (Brazil). Inst. de Fisica
BRST quantization of spinning relativistic particles with extended supersymmetries, 15:49959 (R;BR)
Double beta decay, neutrino physics, nuclear structure and isospin and spin-isospin symmetries, 15:49926 (R;BR)
Functionals Hartree-Fock equations in the Schrodinger representation of quantum field theory, 15:50094 (R;BR)
Gauge structure, anomalies and mass generation in a three dimensional thirring model, 15:49965 (R;BR)
Luminescence study of spodumene, 15:50071 (R;BR)
Manual for target thickness measurement by alpha particle irradiation, 15:50055 (R;BR;In Portuguese)
Quantum mechanics of relativistic particles in multiply connected spaces and the Aharonov-Bohm effect, 15:50095 (R;BR)
Selection of collective degrees of freedom in the boson space, 15:49964 (R;BR)
Symmetries of Chern-Simons theory in Landau gauge, 15:49958 (R;BR)

Saskatchewan Air and Land Protection Branch, Regina, SK (Canada)
Chemical use and distribution in the Regina aquifer region. Volume I: Executive Summary – Volume II: Report and appendices, 15:49602 (R;CA)

Saskatchewan Dept. of Energy and Mines, Regina, SK (Canada)
Saskatchewan Energy and Mines annual report, 1988-89, 15:48728 (R;CA)

Saskatchewan District, Regina (Canada). Water Resources Branch
Response to recommendation No. 80, Beaufort Sea environmental assessment and review panel: Final report, 1984-89, 15:48171 (R;CA)

Saskatchewan Research Council, Saskatoon, SK (Canada)
Effects of produced sand on short distance pipeline transportation of heavy oil in water emulsions: SRC [Saskatchewan Research Council] pipeloop test results: Final report, 15:48172 (R;CA)

Saskoil-Saskatchewan Oil and Gas Corp., Regina, SK (Canada)
Saskoil annual report 1988, 15:48144 (R;CA)

Science Applications International Corp., Norristown, PA (USA)
Assessment of physical coal-cleaning practices for sulfur removal. Final report, April 1986-January 1990, 15:48073 (R;US)

Science Applications International Corp., San Diego, CA (USA)
Overview and comparison of US commercial nuclear power plants: Nuclear power plant system sourcebook, 15:48539 (R;US)

Second Wind, Inc., Somerville, MA (USA)
Low-cost cogeneration system controller development. Final report, May 1988-July 1989, 15:48823 (R;US)

Siemens AG Unternehmensbereich KWU, Erlangen (Germany, F.R.). Bereich Energieerzeugung
Retention capacity of rock salt. Final report, 15:48289 (R;DE;In German)

Soils Systems, Inc., Marietta, GA (USA)
Ecological characterization atlas of coastal Alabama: Map narrative, 15:49571 (R;US)

Solar Energy Research Inst., Golden, CO (USA)
Assessment of municipal solid waste for energy production in the western United States, 15:48833 (R;US)
Atmospheric performance of the special-purpose Solar Energy Research Institute (SERI) thin-airfoil family: Final results, 15:48484 (R;US)
Conceptual design of an open-cycle ocean thermal energy conversion net power-producing experiment (OC-OTEC NPPE), 15:48471 (R;US)
Evaluation of a high-temperature burner-duct-recuperator system: A technical case study, 15:48806 (R;US)
Performance and cost projections for advanced wind turbines, 15:48483 (R;US)
Research on high-efficiency, large area amorphous silicon based solar cells: Final subcontract report, February 1, 1989–February 28, 1990, 15:48462 (R;US)
Research on high-efficiency, multiple-gap, multi-junction amorphous silicon-based alloy thin-film solar cells: Final subcontract report, March 1, 1987–February 28, 1990, 15:48464 (R;US)
SERI workshop on the role of point defects/defect complexes in silicon device fabrication: Book of abstracts, 15:48461 (R;US)
Structure of amorphous-silicon and germanium alloy films: Annual subcontract report, January 15, 1989–January 14, 1990, 15:48463 (R;US)

Solarex Corp., Newtown, PA (USA). Thin Film Div.
Research on high-efficiency, large area amorphous silicon based solar cells: Final subcontract report, February 1, 1989–February 28, 1990, 15:48462 (R;US)

South African Astronomical Observatory, Cape Town (South Africa)
The South African Astronomical Observatory, 15:49826 (R;ZA)

South Carolina Univ., Columbia, SC (USA). Dept. of Electrical and Computer Engineering
Compact representation of radiation patterns using spherical mode expansions: Final report, 15:49219 (R;US)

Southern Co. Services, Inc., Birmingham, AL (USA)
Innovative Clean Coal Technology (ICCT): 180 MW demonstration of advanced wall-fired combustion techniques for the reduction of nitrogen oxides (NOx) emissions from coal-fired boilers: Quarterly technical progress report, first quarter 1990, 15:48513 (R;US)

Southern Research Inst., Birmingham, AL (USA)
User-friendly data entry routine for the ESP model. Final report, June 1988-September 1989, 15:49545 (R;US)

SRI International, Menlo Park, CA (USA)
Exploratory coprocessing research: Quarterly report No. 7, March 1, 1990–May 31, 1990, 15:48077 (R;US)
Improved Fischer-Tropsch Synthesis catalysts for indirect coal liquefaction: Quarterly technical progress report No. 8, 1 July–30 September 1987, 15:48075 (R;US)
Laboratory particle-velocity experiments on rock from a USSR underground nuclear test site. Technical report, 15:49396 (R;US)

Stanford Univ., CA (USA). Dept. of Geology
Organic chemistry of mantle-derived xenoliths: Assessing the possibilities for deep sources of natural gas. Biennial report, November 1987-November 1989, 15:48179 (R;US)

Stone and Webster Engineering Corp., Boston, MA (USA)
Guide for the application and use of valves in power plant systems: Final report, 15:48602 (R;US)

Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires
Experimental study of the single electron response of the DELPHI Barrel RICH MWPC's, 15:49287 (R;FR)
The main aspects of the Vivitron mechanical structure, 15:49242 (R;FR)

Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme
Investigations of defined oxides for improving the determination of emissivity of high temperatures. Pt. 1 and 2. Pt. 1: Determination of emissivity and optical constants. - Pt. 2: Preparation and analysis of probes, 15:48874 (R;DE;In German)

Suomen Akatemja, Helsinki (Finland)
Particle emissions, 15:49549 (R;FI)

Sussex Univ., Brighton (UK)
Baryogenesis in extended inflation. Part 1: Baryogenesis via production and decay of supermassive bosons, 15:49818 (R;GB)
Classical theory of radiating strings, 15:49823 (R;GB)

Syracuse Univ., NY (USA)
Research program in elementary particle theory: Task A: Progress report ending December 31, 1990, 15:49899 (R;US)

T

Teagasc Agriculture and Food Development Authority, Dublin (Ireland). Rural Economy Research Centre
Impact of renewable derived fuels on energy and agriculture sectors: Final report, 15:48411 (R;LU)

Texas A and M Univ., College Station, TX (USA)
Texas Barrier Islands Region ecological characterization atlas: Socioeconomic and natural features narrative, 15:49569 (R;US)

Texas A and M Univ., College Station, TX (USA). Center for Electrochemical Systems and Hydrogen Research
Lightweight solid-polymer electrolyte fuel cell with stack power density of 3 kW/lb (7kW/kg), 15:48759 (R;US)

Texas Univ., Arlington, TX (USA). Dept. of Chemistry
Preparation of potential radioprotective agents derived from aminothiols. Annual report, 16 July 1985-15 July 1986, 15:49706 (R;US)

Texas Univ., Austin, TX (USA)
On the origin of cosmological magnetic fields, 15:49749 (R;US)

Texas Univ., Austin, TX (USA). Inst. for Fusion Studies
Effects of compressibility, diamagnetic drift, and thermal conduction on resistive ballooning modes in the second stability regime, 15:50119 (R;US)
Natural current profiles in a tokamak, 15:50118 (R;US)
Numerical study of compressible magnetoconvection with an open transitional boundary, 15:49748 (R;US)

Texas Univ., Richardson, TX (USA). Center for Space Sciences
Electrodynamics of the high-latitude ionosphere. Final report, September 1986-September 1989, 15:49858 (R;US)

Texas Univ., San Antonio, TX (USA). Health Science Center
Survival of Chinese hamster ovary cells following ultrahigh-dose-rate electron and bremsstrahlung radiation. Final report, September 1988-February 1989, 15:49707 (R;US)

Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study
Application of in-beam perturbed angular distribution to the study of high-T_c oxides, 15:50072 (R;JP)
Extra weak bosons in a confining gauge theory with complementarity, 15:49938 (R;JP)
KODAQ (Kakuken On-line Data Acquisition System) based on PC-9801 personal computer, 15:50218 (R;JP;In Japanese)
Magnetic properties of Hubbard-sigma model with three-dimensionality, 15:48917 (R;JP)
More sum rules for quark and lepton masses, 15:49939 (R;JP)
Nuclear spectroscopy and quantum chaos, 15:50031 (R;JP)
Nucleosynthesis in the rapid-proton process, 15:50004 (R;JP)
Real-pion states formed by virtual-pion beam: New family of nuclear excited states, 15:49996 (R;JP)
Spin dynamics of the itinerant helimagnet MnSi studied by positive muon spin relaxation, 15:50029 (R;JP)
Towards high-density matter with relativistic heavy-ion collisions, 15:50030 (R;JP)

Toledo Univ., OH (USA). Dept. of Physics and Astronomy
Semiempirical studies of atomic structure: Progress report, July 1, 1990–June 30, 1991, 15:49874 (R;US)

Toronto Univ., ON (Canada). Dept. of Chemical Engineering and Applied Chemistry
Propane storage. Report on hazard and risk assessment of propane storage on garage forecourts, 15:48191 (R;CA)

Transport Canada, Ottawa, ON (Canada)
Maritime Pollution Claims Fund (Canada): Annual report 1988-1989, 15:48150 (R;CA)

Transport Canada, Ottawa, ON (Canada). Research and Development
Maritime Pollution Claims Fund annual report, 1988-1989, 15:48165 (R;CA)

TRW Space and Technology Group, Redondo Beach, CA (USA). Applied Technology Div.
Molten-caustic-leaching (Gravimelt) system integration project: Quarterly report, January–March 1990, 15:48079 (R;US)

TRW, Inc., Redondo Beach, CA (USA)
The TRW entrained combustor retrofit at Orange and Rockland Utilities, Lovett Station Unit 3, 15:48486 (R;US)

TRW, Inc., Redondo Beach, CA (USA). Applied Technology Div.
MHD Technology Transfer, Integration and Review Committee: Third semi-annual status report, April–September 1989, 15:48758 (R;US)

U

UKAEA Harwell Lab. (UK)
International workshop on ion beam modification and processing of high-Tc superconductors: Physics and devices: Program and abstracts, 15:48905 (R;GB)
Retention of alkaline earth elements in man: Final report for the period 1 April 1986 - 14 May 1989, 15:49712 (R;XA)

UKAEA Harwell Lab. (UK). Environmental and Medical Science Div.
Uranium and human diet: a literature review, 15:49710 (R;GB)

UKAEA Northern Research Labs., Springfields (UK)
The MERLIN programme: Pt. 2, A description of the MERLIN rig, 15:48662 (R;GB)

UKAEA Springfields Nuclear Power Development Labs. (UK)
Effects of cathodic protection potential and stress ratio on fatigue thresholds of structured steels in sea water, 15:48894 (R;GB)

Uniformed Services Univ. of the Health Sciences, Bethesda, MD (USA)
Application of high-frequency ventilation to treatment of chemical-warfare casualties: Animal and theoretical studies (application of high-frequency transtracheal jet ventilation to treatment of chemical-warfare casualties). Final report, March 1983-December 1986, 15:49410 (R;US)
Application of high-frequency ventilation to treatment of chemical-warfare casualties: Animal and theoretical studies. Annual report, 1 March 1984-28 February 1985, 15:49411 (R;US)

University Coll. of Wales, Aberystwyth (UK). Dept. of Physics
Amplitude and phase scintillation and ionospheric irregularities at sub-auroral latitudes. Interim report, 30 September 1987-31 March 1989, 15:49855 (R;GB)

University Coll., Cork (Ireland). Dept. of Chemistry
Development of a high performance air cathode for the direct methanol/air fuel cell: Final report, 15:48761 (R;LU)

University of South Florida, Tampa, FL (USA)
Diode laser-pumped single-mode 1.3-microns Nd: YALO microlaser. Final report, 15:49203 (R;US)

University of Southern California, Los Angeles, CA (USA)
Corrosion protection of metal-matrix composites. Final report, October 1986-April 1990, 15:48855 (R;US)

University of Southern California, Los Angeles, CA (USA). Dept. of Chemistry
Computer simulation of chemical reactions in synthetic model compounds and genetically engineered active sites. Final report, 1 July 1989-30 June 1990, 15:49641 (R;US)

University of Southern California, Marina Del Rey, CA (USA). Information Sciences Inst.
Supercomputer work-station communication. Special report, 15:50209 (R;US)

Unocal Corp., Parachute, CO (USA). Energy Mining Div.
UNOCAL Parachute Creek Shale Oil Program. Environmental monitoring plan, annual report, October 1, 1988-September 30, 1989, 15:48207 (R;US)

UOP, Inc., Des Plaines, IL (USA)
Upgrading Fischer-Tropsch naphtha, 15:48078 (R;US)

USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Office of Clean Coal Technology
Comprehensive report to Congress, Clean Coal Technology Program: Full-scale demonstration of low-NOsub x cell burner retrofit, 15:48501 (R;US)

USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use
Short-term energy outlook: Quarterly projections, 15:48739 (R;US)
Short-term integrated forecasting system: 1990 model documentation report, 15:48740 (R;US)

USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas
Natural gas monthly, June 1990, 15:48180 (R;US)

US oil and gas reserves by year of field discovery, 15:48125 (R;US)

USDOE Morgantown Energy Technology Center, WV (USA)

Proceedings of the second annual fuel cells contractors review meeting, 15:48760 (R;US)

USDOE Nevada Operations Office, Las Vegas, NV (USA). Yucca Mountain Project Office

Environmental program overview for a high-level radioactive waste repository at Yucca Mountain, 15:48268 (R;US)

USDOE Office of Administration and Human Resource Management, Washington, DC (USA). History Div.

The Manhattan Project: Science in the Second World War, 15:49397 (R;US)

USDOE Office of Energy Research, Washington, DC (USA). Energy Biosciences Div.

Annual report and summaries of FY 1990 activities, 15:48413 (R;US)

USDOE Office of Energy Research, Washington, DC (USA). Office of Superconducting Super Collider

Report of the Department of Energy (DOE) Office of Energy Research Review Committee on the site-specific conceptual design of the Superconducting Super Collider, 15:49227 (R;US)

USDOE Office of Energy Research, Washington, DC (USA). University and Industry Programs Div.

Guide for the preparation of proposals for the pre-freshman enrichment program, PREP, 1991, 15:48834 (R;US)

USDOE Office of Policy, Planning and Analysis, Washington, DC (USA). Resource Management

Assessment of costs and benefits of flexible and alternative fuel use in the US transportation sector: Technical report four: Vehicle and fuel distribution requirements, 15:48845 (R;US)

USDOE Richland Operations Office, WA (USA)

Nonradioactive dangerous waste landfill closure/postclosure plan, 15:48263 (R;US)

State of Washington Department of Health, radioactive air emissions Permit FF01: Supplemental information, 15:48618 (R;US)

Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)

Experimental research of local hydrodynamic characteristics of fast reactor fuel assembly peripheral zone. 5: Results of measurement at group displacement. SPOGVY variants, 15:48584 (R;CS;In Russian)

Experimental research of local hydrodynamic characteristics of fast reactor fuel assembly peripheral zone. 6: Turbulent flow microstructure at a group displacement of the rods, 15:48585 (R;CS;In Russian)

Experimental research of local hydrodynamic characteristics of fast reactor fuel assembly peripheral zone. 7: Results of measurement in entry section of model, 15:48586 (R;CS;In Russian)

List of publications 1989, 15:50208 (R;CS;In Czech, English)

Rod drop in the LR-0 reactor core comprising 55 fuel assemblies: A comparison of theoretical and experimental data, 15:48599 (R;CS;In Russian)

V

Versar, Inc., Springfield, VA (USA)

Amendment to best demonstrated available technology (BDAT) background document for K037. Final report, 15:49511 (R;US)

Amendment to the best demonstrated available technology (BDAT) background document for wastes from the petroleum refining industry K048, K049, K050, K051, K052. Final report, 15:48146 (R;US)

Amendment to the final best demonstrated available technology (BDAT) background document for wastes from the production of 1,1,1-trichloroethane K028, K029, K095, and K096. Final report, 15:49502 (R;US)

Amendment to the final best demonstrated available technology (BDAT) background document for distillation bottom tars from the production of phenol/acetone from cumene K022. Final report, 15:49506 (R;US)

Amendment to the final best demonstrated available technology (BDAT) background document for wastes from the production of chlorinated aliphatic hydrocarbons F024. Final report, 15:49513 (R;US)

Best demonstrated and available technology (BDAT) background document for wastes from the production of epichlorohydrin K017. Final report, 15:49606 (R;US)

Best demonstrated available technology (BDAT) background document. Final, May 1990, 15:49474 (R;US)

Best demonstrated available technology (BDAT) background document for wastes, 15:49498 (R;US)

Best demonstrated available technology (BDAT) background document for wastes from the production of chlorinated aliphatics F025. Volume 1. Final report, 15:49499 (R;US)

Best demonstrated available technology (BDAT) background document for U and P wastes and multisource leachates. Volume D. Reactive U and P waste waters and nonwaste waters. Final report, 15:49501 (R;US)

Best demonstrated available technology (BDAT) background document for U and P wastes and multi-source leachate (F039). Volume A. Wastewater forms of organic U and P wastes and multi-source leachate (F039) for which there are concentration-based treatment standards. Final report, 15:49503 (R;US)

Best demonstrated available technology (BDAT) background document for U and P wastes and multi-source leachate (F039). Volume B. U and P wastewaters and nonwaste waters with methods of treatment as treatment standards. Final report, 15:49504 (R;US)

Best demonstrated available technology (BDAT) background document for U and P wastes and multi-source leachate (F039). Volume C. Nonwastewater forms of organic U and P wastes and multi-source leachate (F039) for which there are concentration-based treatment standards. Final report, 15:49505 (R;US)

Best demonstrated available technology (BDAT) background document for distillation bottoms from the production of aniline K083. Final report, 15:49507 (R;US)

Best demonstrated available technology (BDAT) background document for distillation bottoms from the production of nitrobenzene by the nitration of benzene K025. Final report, 15:49508 (R;US)

Best demonstrated available technology (BDAT) background document for stripping still tails from the production of methyl ethyl pyridines K026. Final report, 15:49509 (R;US)

Best demonstrated available technology (BDAT) background document for waste-water treatment sludges generated in the production of creosote K035. Final report, 15:49510 (R;US)

Best demonstrated available technology (BDAT) background document for halogenated pesticide and chlorobenzene wastes K032-K034, K041, K042, K085, K097, K098, K105, D012-D017. Final report, 15:49512 (R;US)

Best demonstrated available technology (BDAT) background document for U and P wastes and multi-source leachate (F039). Volume E. Gaseous U and P wastes. Final report, 15:49514 (R;US)

Final best demonstrated available technology (BDAT) background document for K031, K084, K101, K102, characteristic arsenic wastes (D004), characteristic selenium wastes (D010), and P and U wastes containing arsenic and selenium listing constituents. Volume 1, 15:49475 (R;US)

Final best demonstrated available technology (BDAT) background document for characteristic ignitable wastes (D001), characteristic corrosive wastes (d002), characteristic reactive wastes (D003), and P and U wastes containing reactive listing constituents. Volume 2, 15:49476 (R;US)

Final best demonstrated available technology (BDAT) background document for K001 (addendum) and U051 (creosote). Volume 3, 15:49477 (R;US)

Final best demonstrated available technology (BDAT) background document addendum for K015. Volume 4, 15:49478 (R;US)

Final best demonstrated available technology (BDAT) background document for K073. Volume 5, 15:49479 (R;US)

Final best demonstrated available technology (BDAT) background document for K021. Volume 6, 15:49480 (R;US)

Final best demonstrated available technology (BDAT) background document for K086 (ink-formulation-equipment cleaning wastes). Volume 7, 15:49481 (R;US)

Final best demonstrated available technology (BDAT) background document for K060. Volume 8, 15:49482 (R;US)

Final best demonstrated available technology (BDAT) background document for K061 (Addendum). Volume 9, 15:49483 (R;US)
Final best demonstrated available technology (BDAT) background document for K046 (Addendum). Volume 10, 15:49484 (R;US)
Final best demonstrated available technology (BDAT) background document for F006 waste waters (Addendum). Volume 13, 15:49487 (R;US)
Final best demonstrated available technology (BDAT) background document addendum for cyanide wastes. Volume 14, 15:49488 (R;US)
Final best demonstrated available technology (BDAT) background document addendum for acrylonitrile wastes (K011, K013, and K014). Volume 15, 15:49489 (R;US)
Final best demonstrated available technology (BDAT) background document addendum for F002 (1,1,2-trichloroethane) and F005 (benzene, 2-ethoxyethanol, and 2-nitropropane). Volume 16, 15:49490 (R;US)
Final best demonstrated available technology (BDAT) background for mercury-containing wastes D009, K106, P065, P092, and U151. Volume 17, 15:49491 (R;US)
Final best demonstrated available technology (BDAT) background document for P and U thallium wastes. Volume 18, 15:49492 (R;US)
Final best demonstrated available technology (BDAT) background document for vanadium-containing wastes (P119 and P120). Volume 19, 15:49493 (R;US)
Final best demonstrated available technology (BDAT) background document for barium wastes (D005 and P013). Volume 20, 15:49494 (R;US)
Final best demonstrated available technology (BDAT) background document for D006 cadmium wastes. Volume 21, 15:49495 (R;US)
Final best demonstrated available technology (BDAT) background document for chromium wastes D007 and U032. Volume 22, 15:49496 (R;US)
Final best demonstrated available technology (BDAT) background document for D008 and P and U lead wastes. Volume 23, 15:49497 (R;US)
Final treatment standards for K069 nonwaste waters in the calcium sulfate/sodium subcategory and waste-water forms of K069. Volume 11. Memorandum report, 15:49485 (R;US)
Final treatment standards for nonwaste-water and waste-water forms of K100. Volume 12. Memorandum report, 15:49486 (R;US)
Treatment standards for nonwaste-water and waste-water forms of K044, K045, and K047. Volume 2. Final report, 15:49500 (R;US)
Waste-minimization opportunity assessment, Fort Riley, Kansas. Summary report, April 1989-December 1989, 15:49613 (R;US)

Virginia Center for Coal and Minerals Processing, Blacksburg, VA (USA)
In-plant testing of microbubble column flotation: Technical progress report second quarter, January 1, 1990–March 31, 1990, 15:48072 (R;US)

Virginia Univ., Charlottesville, VA (USA)
Corrosion fatigue crack propagation in metals, 15:48893 (R;US)

Virginia Univ., Charlottesville, VA (USA). Dept. of Materials Science
Investigation of thermo-mechanical effects in silicon carbide whisker/Al alloy composites. Final report, 1 March 1985-31 August 1989, 15:48902 (R;US)

W

Washington Univ., Seattle, WA (USA)
Two and three dimensional magnetotelluric inversion: Annual progress report, 15:49733 (R;US)

Washington Univ., St. Louis, MO (USA). Dept. of Physics
Structure of amorphous-silicon and germanium alloy films: Annual subcontract report, January 15, 1989–January 14, 1990, 15:48463 (R;US)

West Virginia Univ., Morgantown, WV (USA). Dept. of Chemical Engineering
Reaction kinetics of the CaO-SO_2 system in absence of inter-grain pore diffusion: Annual report, 15:48108 (R;US)

West Virginia Univ., Morgantown, WV (USA). Dept. of Mechanical and Aerospace Engineering
Deposition, corrosion, erosion and sulfur emission studies related to coal combustion: Annual report, 15:48109 (R;US)

Western Research Inst., Laramie, WY (USA)
Distribution of a crystalline nickel (II) porphyrin in the Green River Formation, 15:48206 (R;US)
Formation of calcium and magnesium molybdate complexes in dilute aqueous solutions and evaluation of powellite solubility in spent oil shale, 15:48202 (R;US)

Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.
Waste Isolation Pilot Plant site specific plan: Revision 2, 15:48260 (R;US)

Westinghouse Hanford Co., Richland, WA (USA)
Hanford Site radioactive solid waste acceptance criteria, 15:48292 (R;US)
Liquid effluent study project plan: Environmental and waste management: Revision 2, 15:48293 (R;US)
N reactor external events probabilistic risk assessment using NUREG-1150 methods, 15:48669 (R;US)
Simulation of alpha continuous air monitor alarm response in the presence of plutonium, 15:49557 (R;US)

Weston (Roy F.), Inc., West Chester, PA (USA)
Task Order 2 enhanced preliminary assessment, Fort Douglas, Salt Lake City, Utah. Final report, October-December 1989, 15:49416 (R;US)
Task order enhanced preliminary assessment, New Orleans Military Ocean Terminal, New Orleans, Louisiana. Final report, October-December 1989, 15:49417 (R;US)

Wimpey Labs. Ltd., Hayes (UK)
A passive solar heating facility for existing houses: Demonstration project: Final report, 15:48473 (R;LU)

Wisconsin Univ., Madison, WI (USA)
Computation of emissions from exhaust-gas composition measurements, 15:48148 (R;US)
Morphological analysis of ionomers: Progress report, April 1, 1989–March 31, 1990, 15:48954 (R;US)
Variable eigenmode excitation in the beach heating of two-ion-species mirror plasmas, 15:50120 (R;US)

Wisconsin Univ., Madison, WI (USA). Dept. of Horticulture
Mechanism for the selective conjugation of ubiquitin to phytochrome: Progress report for 1989, 15:49643 (R;US)

Wisconsin Univ., Madison, WI (USA). Plasma Physics Research
Confinement and fluctuations in the MST [Madison Symmetric Torus] reversed field pinch, 15:50115 (R;US)

Woods Hole Oceanographic Institution, MA (USA). Coastal Research Center
US Mussel Watch Program: Transuranic element data from Woods Hole Oceanographic Institution 1976-1983. Technical report, 15:49610 (R;US)

Y

Yale Univ., New Haven, CT (USA)
Differential seeding and regeneration in openings and beneath closed canopy in sub-tropical wet forest, 15:49568 (R;US)
Theoretical and numerical studies in magnetic mirror fusion: Progress report, 15:50116 (R;US)

Personal Author Index

Authors' surnames are indexed in the form appearing in the publication cited; given names generally have been reduced to initials. For documents with multiple authors, each author name is indexed. The entry for a primary author (first author listed on an abstracted document) includes the full document title and citation number. Entries for other authors provide a cross-reference to the primary author. Also included is information on the document type, country of publication, and the document language listed in parentheses in the format (J;FR;In French and English). Accent marks are not input because of computer alphabetization. Spelling and transliteration follow standard conventions.

A

Aaltonen, P., *See* Toerronen, K., 15:48521

Abarenov, A.V., Dissociative recombination of molecular ions H_2^+, 15:49875 (R;SU;In Russian)

Abbott, D.G., Experience with certifying borated stainless steel as a shipping cask basket material: Volume 1, 15:48383 (BA;US)

Abbrecht, P.H., Application of high-frequency ventilation to treatment of chemical-warfare casualties: Animal and theoretical studies (application of high-frequency transtracheal jet ventilation to treatment of chemical-warfare casualties). Final report, March 1983-December 1986, 15:49410 (R;US)

Application of high-frequency ventilation to treatment of chemical-warfare casualties: Animal and theoretical studies. Annual report, 1 March 1984-28 February 1985, 15:49411 (R;US)

Abdallah, K., *See* Douss, N., 15:48781

Abdullin, Kh.A., Hydrogen passivation of radiation-induced defects in silicon: 2. Solid state physics and mass transfer simulation, 15:50081 (RA;SU;In Russian)

Investigation of radiation-induced defects in p-Si by deep level nonstationary capacitance spectroscopy method: 2. Solid state physics and mass transfer simulation, 15:50083 (RA;SU;In Russian)

Abdullin, S.K., Cumulative nucleon production in ^{3}Hep- and ^{3}Hp interactions at momenta of colliding nuclei 5 GeV/c, 15:49997 (R;SU;In Russian)

Abe, Kazuo, Comparison of B factories, 15:49953 (RA;JP;In Japanese)

Abe, Y., *See* Kamimoto, M., 15:48475

Abe, Yutaka, *See* Okubo, Tsutomu, 15:48657

Abraham, M.M., *See* Poirot, I.S., 15:49020

See Williams, G.M., 15:49022, 15:49023

Abrahams, K., Nuclear physics at the HFR, 15:48624 (RA;FR)

Abrahams, S., What do you do when the network is 1 to 2 orders of magnitude faster than the backplane bus?, 15:50243 (R;US)

Abramov, A.G., Mathematical model and program for superconducting magnet mechanics study, 15:49256 (R;SU;In Russian)

Achando, S.S., *See* Martinez, D.Y.F., 15:49713

Ackerbauer, P., *See* Petitjean, C., 15:50186, 15:50187

Adachi, Hiromichi, *See* Okubo, Tsutomu, 15:48657

Adam, E., *See* Hennig, D., 15:48546

Adams, K., Upgrading user interfaces to computational chemistry codes, 15:48987 (R;US)

Adams, W.A., Electrical power sources inventory for Transport Canada, 15:48755 (R;CA)

Adel, G.T., *See* Yoon, R.H., 15:48072

Adkins, D.R., Bench-scale testing of a heat-pipe receiver for solar thermal electric applications, 15:48470 (R;US)

Aegerter, M.A., *See* Craievich, A.F., 15:48909

Agasyan, N.O., Quantum corrections to kink-type classical solution in one-dimensional phi 4 model: 1. High energy physics and computer technique, 15:49976 (RA;SU;In Russian)

Ageev, A.I., Measurement of the longitudinal thermal conductivity for spiral tube-fin heat exchanger structure for helium facilities, 15:49181 (R;SU;In Russian)

Agnvall, P., *See* Piercy, R.B., 15:49328

Ahlf, J., High flux reactor Petten present and future programme, 15:48622 (RA;FR)

Prospects and future utilization, 15:48621 (R;FR;In EN, DE)

Ahmad, I., *See* Khoo, T.L., 15:50011

Ahn, B.T., *See* Burmester, C.P., 15:48932

Aiello, J.P., A coal fired steam generator demonstration for heavy oil recovery operations, 15:48194 (RA;CA)

Aihara, K., *See* Matsumoto, T., 15:48935

Aiken, C.L.V., *See* Ander, M.E., 15:50107

Ainsworth, R.A., Flaw assessment procedure for high temperature reactor components, 15:48580 (R;US)

Aitken, D.K., Spectropolarimetry as a diagnostic of the interstellar medium: Proceedings of the 22. Esiab Symposium, 15:49761 (RA;FR)

Altov, G.M., *See* Shvedov, O.V., 15:48627, 15:48628, 15:48629

Aittola, J.P., The theory and technics of particle measuring methods: Controlling measurements. Dust, 15:49556 (RA;FI)

Aizman, A., *See* Contreras, R., 15:49032

Akhiezer, I.A., On the diffusion in metallic glasses near the vitrification temperature, 15:48959 (R;UA;In Russian)

Akhmetov, E.A., *See* Agasyan, N.O., 15:49976

Akimenko, S.A., Study on the $\pi^+ \rightarrow \eta$ and $\pi^+ \rightarrow \pi^0\pi^0$ exclusive processes on nuclei at 10.5 GeV/c, 15:49910 (R;SU;In Russian)

Akimoto, Hajime, *See* Okubo, Tsutomu, 15:48657

Akimov, Yu.K., Investigation of anomalous pion production in the reaction Cu(p,π^+)X by 350 MeV protons: Collection, 15:50010 (RA;SU)

Akopova, A.B., Identification of cosmic heavy nuclei in an assembly of nuclear photoemulsions and dielectric track detectors, 15:49292 (R;SU;In Russian)

Akopyan, V.P., Optimization of the shape of the bending magnets cross section for electron accelerators and storage rings, 15:49246 (R;SU)

Al-Mufti, S., *See* Wickramasinghe, N.C., 15:49758

Alanakyan, K.V., Characteristics of the electron beam extracted onto the Deuteron-2 installation in the low background room of the Erevan synchrotron, 15:49248 (R;SU;In Russian)

Alekseev, A.I., Model of chromoelectric charges confinement, 15:49930 (R;SU)

Alessi, J.G., The BNL 200 MeV H^- linac: Performance and upgrades, 15:49239 (R;US)

Alexander, D., Overview of the U.S. Department of Energy's PACE-90 geologic repository performance assessment exercise activity: Volume 1, 15:48355 (BA;US)

Alexander, D.J., *See* Naus, D.J., 15:48608

Aljekhin, G.V., *See* Fil, N.S., 15:48554

Allard, L.F., *See* Blake, D.F., 15:48960

Allen, D.A., *See* Spyromilio, J., 15:49789

Allen, G.C., *See* Falci, F.P., 15:49171

Allen, W.R., High energy iron ion implantation into sapphire, 15:50069 (R;US)

Alley, G.T., *See* Bryan, W.L., 15:49561

See Newport, D.F., 15:49222

Almagri, A.F., *See* Sprott, J.C., 15:50115

Almeida, A.L., *See* Braga, M., 15:49046

Almeida, C., IAEA activities in computer aided safety analysis: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48519 (RA;XA)

Alper, B., *See* Davies, J.D., 15:50198

Altenhofen, M.K., Evaluation of near-field thermal environment conditions for a spent fuel repository in tuff: Volume 1, 15:48320 (BA;US)

Altynov, V.A., *See* Korenev, S.A., 15:50078
Amador, M., International english, 15:50254 (R;US)
Amaglobeli, A.N., Supersymmetric version of horizontal gauge interactions, 15:49931 (R;SU)
Amano, Kaoru, 'String amplitudes': What can we do about the divergent integrals?, 15:49975 (RA;JP)
Amano, Tsuneo, *See* Urata, Kazuhiro, 15:50163
Amaryan, M.Dzh., *See* Alanakyan, K.V., 15:49248
Amberger, H.D., The electronic structure of organometallic complexes of the f elements - XXIII. Interpretation of the magnetochemical and optical data of a tetrahydrofuran adduct derived from tris(η^5 cyclopentadienyl)-ytterbium(III), 15:49064 (RA;US)
Ameen, M.S., *See* Krauss, A.R., 15:48911
Ameev, S.Sh., Determination of number of interacting nucleons in the nuclear pionization model, 15:50047 (R;SU;In Russian)
On the strange particle production in the nuclear pionization model, 15:50043 (R;SU;In Russian)
Amidei, D., *See* Haber, C., 15:49273
See Yarema, R.J., 15:49371
Ammers, H. van, *See* Henshaw, E.T., 15:49668
See Julius, H.W., 15:49667
Ammosov, V.V., *See* Brunner, J., 15:49928
Amroun, A., *See* Platchkov, S., 15:49904
Ander, M.E., A new field experiment in the Greenland ice cap to test Newton's inverse square law: Volume 571, 15:50107 (BA;US)
Andersen, R.A., *See* Berg, D.J., 15:49018
See Burns, C.J., 15:49016, 15:49017
See Edelstein, N.M., 15:49004
See Stults, S.D., 15:49006
See Zalkin, A., 15:49008, 15:49010
Anderson, A.N., *See* Davies, J.D., 15:50198
See Jones, S.E., 15:50184
Anderson, D., Prestudy of burn control in NET: Second intermediate report, February 1990, 15:50113 (R;SE)
Anderson, D.F., *See* Woody, C.L., 15:48940
Anderson, D.M., On the stability and bonding in bis(η-arene)lanthanide complexes, 15:49063 (RA;US)
Anderson, E.N., Managing technical information in a multicontractor environment, 15:50255 (R;US)
Anderson, H.E., Relationship of fuel size and spacing to combustion characteristics of laboratory fuel cribs. Forest Service research paper, 15:48437 (R;US)
Anderson, R.J., Improved tracking for bilateral teleoperators with time delay, 15:49166 (R;US)
Anderson, S., *See* Schulze, D., 15:49565
Anderson, S.T.G., Spectrographic determination of impurities in high-purity tantalum oxide and niobium oxide, 15:49081 (R;ZA)
Andersson, L., Fabric filters: Filtermedia, 15:49553 (RA;FI)
Andres, L, *See* Shan-Hsin, Chiang, 15:49452
Andress, D., Evaluating and controlling the characteristics of the nuclear waste in the FWMS using waste stream analysis model: Volume 1, 15:48366 (BA;US)
Andrews, J.E. Jr., *See* Nguyen, Son N., 15:49560
Andrews, L.A., *See* Neilsen, M.K., 15:49217
Andreyev, B.A., Geologic interpretation of gravity anomalies, 15:48124 (R;US)
Ang, J.A., *See* Hawke, R.S., 15:49167
Ang, T.G., Field trial procedure to assess the behavior of photovoltaic modules under natural condition, 15:48458 (R;FR)
Angel, E.C., *See* Trowbridge, L.D., 15:48216
Angel, S.M., *See* Langry, K.C., 15:49637
Anne, R., *See* Bazin, D., 15:50003
See Guillemaud-Mueller, D., 15:50005
Anno, G.H., *See* Dore, M.A., 15:49708
Anoda, Yoshinari, *See* Suzuki, Mitsuhiro, 15:48656
Antalik, R., Neutron-proton ratios of collective quadrupole matrix elements in even Fe and Cr isotopes, 15:50040 (R;SU)
Antonacci, J.R., *See* Piercy, R.J., 15:48235
Antonelli, M., *See* Fonzi, F., 15:48429
Antoniak, Z.I., *See* Drost, M.K., 15:48496
Antonini, R., *See* Isotani, S., 15:50071
Antonopoulos, K., Results and hazards of postoperative radiotherapy using orthovoltage (300 kV) in carcinomas of the breast, 15:49690 (R;DE;In German)
Apfel, R.E., *See* Sisk, D.R., 15:49355
Appleby, A.J., Lightweight solid-polymer electrolyte fuel cell with stack power density of 3 kW/lb (7kW/kg), 15:48759 (R;US)
Apted, M.J., Mass-transfer anaylsis of waste packages containing defense waste processing facility glass as a waste form: Volume 1, 15:48315 (BA;US)
Arakelyan, E.A., Low-pressure chamber for registration of fission fragments of heavy nuclei, 15:49289 (R;SU)
Aratono, Yasuyuki, *See* Saeki, Masakatsu, 15:49149
Arbuzov, B.A., *See* Alekseev, A.I., 15:49930
Archinoff, G.H., Low enriched uranium fuel in CANDU reactors: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988, 15:48252 (RA;XA)
Arkhipov, A.A., One-gluon exchange approximation for quasipotential of two-quark interaction in quantum chromodynamics, 15:49929 (R;SU)
Single-time reduction of bethe-salpeter formalism for two-fermion system, 15:49966 (R;SU)
Arlinghaus, H.F., *See* Brown, G.M., 15:49647
Arlotto, G., Nuclear plant aging research in the United States: Summary report, 15:48522 (RA;XA)
Armantrout, G.A., *See* Heywood, A.C., 15:49176
Armstrong, D.S., Capture and transfer of pions in hydrogenous materials, 15:49894 (R;CA)
Armstrong, T.R., Dielectric properties of fluxed barium titanate ceramics with zirconia additions, 15:48945 (J;US)
Arnold, B.J., Coal handleability: Addressing the concerns of the electric utility industry, 15:48104 (R;US)
Arnone, G.J., A programmable multichannel correlation module for analyzing neutron multiplicities, 15:49337 (J;US)
Arpishkin, Yu.P., GITTAM program for numerical simulation of one-dimensional targets TIS. Part 2: 2. Description of algorithm and program, 15:50219 (R;SU;In Russian)
Arrowood, L., *See* Tonn, B.E., 15:48699
Arsen'ev, A.V., Installation of disruption instability in the Uragan-2 large-shear stellarator, 15:50160 (R;UA;In Russian)
Arthur, J.E., Steam circulation in horizontal wellbores, 15:48196 (RA;CA)
Artykov, A.M., *See* Akimenko, S.A., 15:49910
Arutyunyan, M.M., *See* Akopova, A.B., 15:49292
Arutyunyan, V.V., Modernization of the VMR-2 monochromator and its use in a synchrotron radiation channel, 15:49243 (R;SU;In Russian)
Arya, R.R., Research on high-efficiency, large area amorphous silicon based solar cells: Final subcontract report, February 1, 1989–February 28, 1990, 15:48462 (R;US)
Asaduzzaman, M., Global climate change and coastal zone management in Bangladesh: Issues and options, 15:49441 (RA;US)
Asai, Kiyoshi, *See* Higuchi, Kenji, 15:50221
Asano, H., Survey of utility real-time pricing programs in the U.S, 15:48683 (R;JP;In Japanese)
Asano, K.A., *See* Glish, G.L., 15:49558
Asay, J.R., *See* Hawke, R.S., 15:49167
Ashby, M.R., SICADS: Site Independent Configurable Alarm Display System, 15:50240 (R;US)
Asherova, R.M., Collective bands in actinide nuclei and rare-earth elements in the SU(3) scheme, 15:50025 (R;SU;In Russian)
Asryan, G.A., *See* Alanakyan, K.V., 15:49248
Assadi, S., *See* Sprott, J.C., 15:50115
Atkins, W.S., *See* Read, D., 15:48275
Attaway, C.R., *See* Best, R.E., 15:48237
Attia, A.V., *See* Rubin, M.B., 15:49400
Atwell, W., *See* Wilson, J.W., 15:49716
Aubineau, A., *See* Proix, R., 15:48767
Auciello, O., *See* Krauss, A.R., 15:48911
Audy, P., The transverse displacement in a circular accelerator disturbs the hexapolar non-linearities. Application to the dynamical aperture problem, 15:49232 (R;FR;In French)
Auffret, S., *See* Platchkov, S., 15:49904
Augenbroe, G, Integration of simulation into building design: The need for a joint approach, 15:48783 (R;US)
Aul'chenko, V.M., Information plates TP, δT and T2A for the KLYuKVA data collection system, 15:49207 (R;SU;In Russian)

Austregesilo, H., The GRS thermalhydraulic system code ATHLET: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48533 (RA;XA)
Autin, M., Laser spectroscopy in a laser-produced plasma at atmospheric pressure: comparison between A.E.S., L.I.F., and L.E.I./R.I.S. for the analysis of solid samples, 15:48990 (R;FR)
Avakyan, Eh.O., *See* Avakyan, R.O., 15:49245
Avakyan, R.O., Experimental set-up for investigation of high-energy electrons scattering and radiation during their channeling in monocrystals, 15:49245 (R;SU;In Russian)
Avakyan, V.V., Technique for investigation of hadron groups in ionization calorimeter, 15:49288 (R;SU;In Russian)
Avetisyan, A.Eh., *See* Avakyan, R.O., 15:49245
Azevedo, S., *See* Schneberk, D., 15:49318
Aziz, K., *See* Gajdica, R.J., 15:48135
Azmy, Y.Y., On the adequacy of message-passing parallel supercomputers for solving neutron transport problems, 15:50053 (R;US)
Parallel performance models for the nodal transport method on the hypercube, 15:50213 (R;US)
Azua, M.C.R. de, *See* Contreras, R.H., 15:50066

B

Babelay, E.F., *See* Barkman, W.E., 15:49169
Babenko, V.A., *See* Sitenko, A.G., 15:49945
Baca, T.J., *See* Bell, R.G., 15:49190
Bacigalupi, J., *See* Ziock, H.J., 15:49374
Badalec, J., *See* Zacek, F., 15:49876
Baddorf, A.P., Surface anharmonicity: Temperature dependence of phonon energies on Cu(110), 15:50068 (R;US)
Bader, S.D., *See* Liu, C., 15:48861
Badikov, S.A., Neutron cross-section evaluation for ^{15}N, 15:49999 (R;XA)
Baer, H., Searching for 100–300 GeV gluinos at the Tevatron and SSC, 15:49907 (R;US)
The search for very heavy top and the fourth generation, 15:49908 (R;US)
Baes, C.F. Jr., *See* Moyer, B.A., 15:49088
Baeuml, A., Proposed limiting values for performance criteria in acceptance testing of diagnostic X-ray equipment in the Federal Republic of Germany: Tolerances, limiting values and appropriate measuring methods, 15:49662 (RA;GB)
Baeyens, R., *See* Stubbe, E.J., 15:48556
Bagduev, R.I., Total emission current in one-chamber electron-optical converters, 15:49384 (R;SU;In Russian)
Bailey, J.A., *See* Espey, B.R., 15:49799
Bailey, J.M., *See* Marshall, G.M., 15:50188
See Murphy, G.V., 15:48612
Bailey, W.J., The expected condition of spent LWR fuel on delivery to a repository: Volume 1, 15:48370 (BA;US)
Bajbusinov, B.O., *See* Aul'chenko, V.M., 15:49207
Bakac, A., *See* Simunic, J.L., 15:49034
Bakalov, D.D., Relativistic corrections to energy levels of weakly bound states of mesic molecules ddμ and dtμ: Collection, 15:49877 (RA;SU;In Russian)
Baker, D.B., Novel measurements of nuclear spin cross-relaxation in metal hydrides, 15:50076 (R;US)
Baker, R., *See* Probst, W., 15:48362
Balabanov, E., Analysis of bypass lines efficiency in WWER-440: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48555 (RA;XA)
Balabin, A.I., Floquet functions in accelerating-focusing channel with an arbitrary structure of a period, 15:49233 (R;SU;In Russian)
Balachandran, A.P., Research program in elementary particle theory: Task A: Progress report ending December 31, 1990, 15:49899 (R;US)
Balachandran, U., *See* Wu, J.L., 15:49205
Balakirev, V.A., Excitation of regular oscillations and acceleration of charged particles by electron beam in a non-uniform plasma resonator, 15:50159 (R;UA;In Russian)
Balandikov, A.N., JINR synchrophasotron: Operation and improvement (quarters 1,2,1988), 15:49229 (R;SU;In Russian)
Balashov, V.V., Angular-momentum alignment effects under slowing-down of muonic helium ion in the μ CF, 15:50196 (RA;GB)
Balayan, Z.K., 32-input gating circuit for event selection, 15:49291 (R;SU;In Russian)
Balko, B.A., *See* Continetti, R.E., 15:49137
See Weiss, P.S., 15:49138, 15:49885
Ball, A.H., Experience in construction and testing of plastic limited streamer chambers, 15:49331 (J;US)
Ball, J.R., *See* Munson, D.E., 15:48368
Ballesio, P.L., *See* Pani, R., 15:49657
Balyuk, S.A., *See* Shvedov, O.V., 15:48627, 15:48628, 15:48629
Banks, W.W., EE Microfabrication facility toxic gas system: A probabilistic risk assessment using human reliability analysis methods, 15:49731 (R;US)
Barabash, A.S., Possibility of experiments using radiation counters for test electron stability and Pauli principle violation in atoms, 15:49303 (R;SU;In Russian)
Barak, E., High pressure NMR spectroscopy studies: The regioselective hydrogenation mechanism of polynuclear heteroaromatic nitrogen compounds with $Cp^*Rh(CH_3CN)_3^{2+}$ as a catalyst precursor, 15:48082 (BA;US)
Baranaev, Yu.D., A suite of codes for the nuclear power plant design safety analysis: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48582 (RA;XA)
Barbee, T.W. Jr., *See* Chakrabarti, S., 15:49361
Barber, D.H., Canada Brick Quarry Ground Water Survey 8th annual report, 1988-1989, 15:49605 (R;CA)
Barber, J.W., *See* Hearst, J.R., 15:49401
Barbier, J.P., Resistance of solar modules to environment constraints, 15:48456 (R;FR;In French)
Barbier, M.J., High performance electrochemical generators, 15:48764 (R;FR;In French)
Barbieri, R.S., *See* Bonham, R.A., 15:49865
Barbosa, M.R.F.F. de, *See* Martinez, D.Y.F., 15:49713
Barbour, S.L., *See* Ho, Y.A., 15:48166
Barboza, M.F. de, Miniaturized chromatographic radiochemical procedure for ^{131}I - MIBG, 15:49148 (R;BR)
Bard, E., Calibration of the ^{14}C timescale over the past 30,000 years using mass spectrometric U-Th ages from Barbados corals, 15:49029 (J;GB)
Bard, R.L., *See* Ball, A.H., 15:49331
Bardin, D.Yu., Electroweak radiative corrections to deep inelastic scattering at HERA. Charged current scattering, 15:49949 (R;SU)
Barga, R.S., Classification of acoustic emission waveforms for nondestructive evaluation using neural networks, 15:50239 (R;US)
Barker, B.W., *See* Bennett, T.J., 15:49403
Barker, P., *See* Faulkner, K., 15:49663
Barklay, C.D., *See* Ransick, M.H., 15:50235
Barkman, W.E., A process monitoring strategy for a Precision Flexible Manufacturing System, 15:49169 (R;US)
Barlow, F.D., *See* Wong, R.K.W., 15:49455
Barlow, M.J., Planetary nebulae: Proceedings of the 22. Eslab Symposium, 15:49777 (RA;FR)
Barnes, P., *See* Shutt, T., 15:49344
Barnes, R., NMR [nuclear magnetic resonance] studies of hydrogen in metals and hydrides at very high temperatures, 15:50074 (R;US)
Barnes, R.G., *See* Baker, D.B., 15:50076
See Ibanez-Meier, R., 15:50075
Barois, P., *See* Zemb, T., 15:49284
Barr, T., *See* Krauss, A.R., 15:48911
Barraclough, B.L., *See* Suszcynsky, D.M., 15:50084
Barrow, J.D., Baryogenesis in extended inflation. Part 1: Baryogenesis via production and decay of supermassive bosons, 15:49818 (R;GB)
Barsotti, E., A proposed scalable parallel open architecture data acquisition system for low to high rate experiments, test beams and all SSC detectors, 15:49274 (J;US)
See Swoboda, C., 15:49336
Bartlett, N., High-energy oxidizers and delocalized-electron solids, 15:49097 (RA;US)
See Hagiwara, R., 15:48964, 15:49098
See Zemva, B., 15:49099
Barton, J.P., Neutron radiography, 15:48405 (RA;FR)

Baryshev, A.I., The estimate of the threshold energy of Yerevan synchrotron with a new accelerating system, 15:49244 (R;SU;In Russian)
Bashmakov, V.S., FEhl pulse spectrometric neutron generator, 15:49228 (R;SU;In Russian)
Study on beam injection systems of the EhGP-10M charge-exchange electrostatic accelerator, 15:49249 (R;SU;In Russian)
Basko, M.M., GITTAM code for numerical simulation of one-dimensional targets for heavy ion fusion. Part 1: Pt.1 System of equations, 15:50177 (R;SU;In Russian)
GITTAM program for numerical simulation of one-dimensional targets TIS. Part 3: 3. Testing calculations, 15:50178 (R;SU;In Russian)
See Arpishkin, Yu.P., 15:50219
Bass, B.R., *See* Naus, D.J., 15:48608
Bassou, M., *See* Bernier, M.E.R., 15:49867
Basu, A.S., Pre-operational external radiation monitoring in NAPP environs using TLDs (Jan 1987 - Mar 1989), 15:50061 (R;IN)
Batchelor, K., Operational status of the Brookhaven National Laboratory Accelerator Test Facility, 15:49225 (R;US)
Bates, J.K., Vapor hydration and subsequent leaching of transuranic-containing SRL and WV glasses: Volume 1, 15:48981 (BA;US)
Bateson, G.D., *See* Aiello, J.P., 15:48194
Batsche, H., Hydrogeological investigations at the Asse salt mine, 15:48282 (RA;DE;In German)
Batunin, A.V., Massive straight-line string as a model of heavy quarkonium, 15:49932 (R;SU;In Russian)
Numerical study of equation for gluonic cascade with recombination, 15:49936 (R;SU)
Bauer, M.L., *See* Chiles, M.M., 15:49364
See McElhaney, S.A., 15:49564
Bauer, S.J., Prelimary methodology for design of stable drifts for the Yucca Mountain Project: Volume 1, 15:48297 (BA;US)
Baumbaugh, A., *See* Kennedy, C., 15:49329
Baumbaugh, B., *See* Kennedy, C., 15:49329
Baumgartner, C.E., Controlled-pore-size composite nickel oxide structures for carbonate fuel cell cathodes, 15:48765 (J;US)
Baxter, A.M., A review of reactor physics uncertainties and validation requirements for the modular high-temperature gas-cooled reactor, 15:48573 (R;US)
Baxter, J.T., *See* Wang, O.S., 15:48669
Bayatyan, G.L., *See* Arakelyan, E.A., 15:49289
Bayol, R., *See* Legros, J., 15:49685
Bazin, D., Search for β -^{2} He, β - p α and β - ^{3}p in the proton-rich nucleus ^{31}Ar, 15:50003 (R;FR)
See Gaimard, J.J., 15:50006
See Guillemaud-Mueller, D., 15:50005
Bazso, Z., *See* Misak, J., 15:48559
Beam, D.C., *See* Bibler, N.E., 15:48982
Bean, A., *See* Cavalli-Sforza, M., 15:49359
Beard, K.B., *See* Khoo, T.L., 15:50011
Beaudry, B.J., *See* Nakahara, J.F., 15:48956
Beck, R., *See* Beyer, H., 15:48289
Beck, R.N., Nuclear medicine and quantitative imaging research (instrumentation and quantitative methods of evaluation): Progress report, January 15–September 1, 1990, 15:49687 (R;US)
See Cooper, M.D., 15:49688
See Gunter, D.L., 15:49703
See Yasillo, N.J., 15:49348
Beck, S.C., Infrared spectroscopy of star formation in galaxies: extreme conditions and very short time scales: Proceedings of the 22. Eslab Symposium, 15:49797 (RA;FR)
Becker, A.B., Evaluation of unrecovered mobile oil in Texas, Oklahoma, and New Mexico, 15:48136 (BA;US)
Becker, C.H., *See* Tingle, T.N., 15:48179
Becker, P.C., *See* Williams, G.M., 15:49023
Beckstead, J.A., *See* Sprott, J.C., 15:50115
Bedeschi, F., *See* Denby, B., 15:49269
See Haber, C., 15:49273
Bednar, R., *See* Kallinger, W., 15:49665
Beeman, J., *See* Shutt, T., 15:49344
Beer, G.A., *See* Marshall, G.M., 15:50188
Beguin, D., Software to estimate the energy production of wind turbine, 15:48482 (R;FR;In French)
Behymer, E., *See* McWright, G., 15:49380
Belikov, V.V., Quasiequilibrium evolution of compact torus with toroidal field, 15:50176 (R;SU;In Russian)
Belikova, G.V., *See* Belikov, V.V., 15:50176
Bell, J.D., *See* Harris, J.H., 15:50132
See Ritz, C.P., 15:50112
Bell, R.G., Computer modeling of 12-inch actuator shock test performance, 15:49190 (R;US)
Bellotti, A., Research on sweet sorghum (Sorghum Bicolor), 15:48431 (RA;LU)
Belododov, M.V., *See* Batunin, A.V., 15:49936
Belousov, V.I., *See* Akimenko, S.A., 15:49910
Belushkin, A.V., Muon spin relaxation study of protonic superionic conductor $CsHSO_4$, 15:50079 (R;SU)
Bemis, C.E. Jr., *See* Claytor, N., 15:49916
Bemski, G., *See* Linhares, M.P., 15:50067
Ben-Zvi, I., *See* Batchelor, K., 15:49225
Bench, M.W., *See* Vetrano, J.S., 15:48985
Benet, P., *See* Khoo, T.L., 15:50011
Bengtson, R., *See* Ritz, C.P., 15:50112
Bennett, M., *See* Arya, R.R., 15:48462
Bennett, R.G., Development of a detailed core flow analysis code for prismatic fuel reactors, 15:48572 (R;US)
Bennett, T.J., Regional discrimination of quarry blasts, earthquakes and underground nuclear explosions. Final report, 23 March 1987-22 March 1989, 15:49403 (R;US)
Bensammar, S., High resolution infrared spectroscopy of symbiotic stars: Proceedings of the 22. Eslab Symposium, 15:49780 (RA;FR)
Benson, D., *See* Ball, A.H., 15:49331
Berezovskij, E.L., Charge-exchange spectroscopy in the T-15 tokamak, 15:50141 (RA;CS;In Russian)
See Stoeckel, J., 15:50143
Berg, D.J., Electron-transfer chemistry of $(Me_5C_5)_2Yb$: Cleavage of diorganoperoxide and related chalcogenides to give $(Me_5C_5)_2Yb(ER)(L)$ where e is O, S, Se, or Te and L is a Lewis Base; crystal structure of $(Me_5C_5)_2Yb(TePh)(NH_3)$, 15:49018 (RA;US)
See Zalkin, A., 15:49015
Bergman, R.G., Transition metal-catalyzed conversion of CO, NO, H_2, and organic molecules to fuels and petrochemicals, 15:49001 (RA;US)
See McGhee, W.D., 15:49002
See Stoutland, P.O., 15:49056, 15:49057
See Wasserman, P., 15:49003
Berkan, R.C., *See* Bywater, R.L., 15:48611
Berkes, J., Treatment standards for nonwaste-water and wastewater forms of K044, K045, and K047. Volume 2. Final report, 15:49500 (R;US)
Berman, M.R., The small-molecule limit of infrared multiphoton dissociation: Collisional effects in D_2CO, 15:49040 (RA;US)
Bernier, M.E.R., Low temperature susceptibility of large molar volume bcc solid ^{3}He, 15:49867 (R;FR)
Vacancies in BCC solid ^{3}He, 15:49866 (R;FR)
Bernon, R., *See* Zemb, T., 15:49284
Berry, G.F., *See* Chang, S.L., 15:48107
See Lottes, S.A., 15:48106
Berthe, J., Main current development programs in Belgium: Summary report, 15:48607 (RA;XA)
Bertin, A., On the criteria followed in the Gran Sasso measurement on cold nuclear fusion, 15:50201 (RA;GB)
Bertolini, R., Beryllium disease: A summary of the occupational health concern, 15:49718 (R;CA)
Beschastnov, P.M., *See* Bagduev, R.I., 15:49384
Beshouri, S.M., Bis(bis(trimethylsilyl)cyclopentadienyl)(bromo)uranium(III)bis (t-butylisocyanide), 15:49012 (RA;US)
The structures of bis[bis(trimethylsilyl)-cyclopentadienyl](chloro)uranium(III)-[bis(t-butylisocyanide)] and bis[bis(trimethylsilyl)cyclopentadienyl]-(chloro)uranium(III) [bis(t-butylcyanide)], 15:49007 (RA;US)
See Zalkin, A., 15:49009, 15:49011, 15:49013
Best, D.A., *See* Arthur, J.E., 15:48196
Best, R.E., The transportation operations system: A description: Volume 1, 15:48237 (BA;US)

See Grady, S.T., 15:48238
Betts, R.R., Heavy ion transfer reactions: Status and prospects, 15:50024 (R;US)
Beugelsdijk, T.J., Development of a small gantry robotic workcell for deoxyribonucleic acid (DNA) filter array construction, 15:49644 (R;US)
Beveridge, J.L., Experimental area design for operation at high intensities, 15:49265 (R;CA)
Beyer, H., Retention capacity of rock salt. Final report, 15:48289 (R;DE;In German)
Beyers, R., *See* Burmester, C.P., 15:48932
Bharathan, D., Conceptual design of an open-cycle ocean thermal energy conversion net power-producing experiment (OC-OTEC NPPE), 15:48471 (R;US)
Bhatia, A.K., *See* Hu, C.Y., 15:50194
Bhatnagar, R., An integrated operator advisor system for plant monitoring, procedure management, and diagnosis, 15:48614 (J;US)
Bhatt, R.T., Influence of interfacial shear strength on the mechanical properties of SiC fiber reinforced reaction-bonded silicon nitride matrix composites, 15:48969 (R;US)
Bhattl, N., *See* Streets, D.G., 15:49454
Bibler, N.E., Recent results of the effects of gamma radiation on the durability and microstructure of DWPF glass: Volume 1, 15:48982 (BA;US)
Bice, D.E., *See* Mauderly, J.L., 15:49721
Bielik, M., Influence of 14-MeV neutrons and gamma radiation on optical fibers and optoelectronic devices, 15:49366 (RA;CS)
Bierman, S.R., *See* Bowman, S.M., 15:48229
Bieser, F., A multi-channel waveform digitizer system, 15:49338 (J;US)
Bigelow, T.S., *See* Harris, J.H., 15:50132
Biggs, W.R., Vanadyl model compounds in size exclusion-inductively coupled plasma-atomic emission (SEC-ICP-AES) studies of metal complexes in heavy crude oils and residua, 15:48175 (BA;US)
Bigiarbigi, K., *See* Becker, A.B., 15:48136
Bilger, R.W., On reduced mechanisms for methane-air combustion in nonpremixed flames, 15:48438 (J;US)
Billebaud, F., *See* Encrenaz, Th., 15:49755
Biner, S.B., Analysis of deformation characteristics of a heavily deformed Cu- 20%Nb composite, 15:48880 (R;US)
Characterization of short fatigue cracks at notches in SiC particulate aluminum composite, 15:48957 (R;US)
Biondo, A.C., *See* Kocks, U.F., 15:48887
Birdsell, K.H., Simulation of radionuclide retardation at Yucca Mountain using a stochastic mineralogical/geochemical model: Volume 1, 15:48308 (BA;US)
Birkigt, W., Crosslinking of thermoplastics by gamma-irradiation in industrial conditions, 15:48401 (R;GB)
Bishop, J.R., Wave force experiments at the Christchurch Bay Tower with simulated hard marine fouling, 15:49197 (R;GB)
Biswas, R., *See* Soukoulis, C.M., 15:48879
Black, R.W., *See* Cole, C.W., 15:48205
Blacker, T.D., An adaptive finite element technique using element equilibrium and paving, 15:50241 (R;US)
Blackmore, E.W., *See* Beveridge, J.L., 15:49265
Blaise, J., Revision and additions to the energy levels of neutral cerium, ^{244}Cmi, 15:49021 (RA;US)
Blake, D.F., Characterization of electron-beam-induced damage structures in natural fluorite, CaF_2, by analytical electron microscopy, 15:48960 (RA;US)
Blake, G.A., Tunable far-infrared laser spectroscopy of hydrogen bonds: The $K_a = O(u) \rightarrow 1$ (g) rotation-tunneling spectrum of the HCl dimer, 15:49048 (RA;US)
See Busarow, K.L., 15:49000, 15:49136
See Cohen, R.C., 15:49047, 15:49139
Blakely, J., Surface phases and their influence on metal-oxide interfaces: [Progress report], 15:48869 (R;US)
Blanch, H.W., *See* King, R.S., 15:49158
Blanchard, M.B., Linkage between site characterization program and performance and design data needs: Volume 1, 15:48359 (BA;US)
Blanchette, D., *See* Lemieux, R.R., 15:48421
Blanco, A., *See* Colangeli, L., 15:49754
Blank, B., *See* Gaimard, J.J., 15:50006
Blaser, J.P., Cold fusion in palladium: the experimental results from PSI, 15:50197 (RA;GB)
Bleeker, H.J., Strategic Defense Initiative three reasons to stay the course. Individual study project, 15:49407 (R;US)
Bless, S.J., *See* Brar, N.S., 15:49389
Blinov, A.V., *See* Abdullin, S.K., 15:49997
Blokhin, A.I., Consistency of microscopic evaluations and integral experiments for chromium, iron and nickel, 15:50009 (R;XA)
See Badikov, S.A., 15:49999
Blokzijl, P.J., *See* Slooff, W., 15:49537
Blondey, T., *See* Michel, E., 15:48466
Blons, J., Hyperdeformed pear-shaped nuclei, 15:50015 (R;FR)
Bloyd, C.N., *See* Streets, D.G., 15:49429
Bludman, S.A., General relativistic hydrodynamics and radiation transport, 15:50106 (BA;US)
Blumberg, L., Superconducting x-ray lithography source Phase 1 (XLS) safety analysis report, 15:49276 (R;US)
Blumberg, L.N., *See* Murphy, J.B., 15:49275
Blumen, W., Atmospheric processes over complex terrain: Volume 23, No. 45, 15:49458 (R;US)
Blumenfeld, Y., *See* Moretto, L.G., 15:50001
Boatner, L.A., *See* Poirot, I.S., 15:49020
See Williams, G.M., 15:49022, 15:49023
Bobylev, A.V., Sparking limit of the accelerating gap of the heavy ion accelerator, 15:49258 (R;SU)
Bode, M., Infrared spectroscopy of novae and related objects: Proceedings of the 22. Eslab Symposium, 15:49778 (RA;FR)
Bodvarsson, G.S., *See* Zimmerman, R.W., 15:48338
Bodwen, D.M., *See* Sastry, S.M., 15:48903
Boehnlein, G., *See* Rehm, H-J., 15:49673
Boese, R., *See* Newman, D.A., 15:49053
Bogart, J., *See* League, J., 15:48164
Bogaty, J.M., A very wide bandwidth Faraday cup suitable for measuring gigahertz structure on ion beams with velocities down to $\beta < 0.01$, 15:49241 (R;US)
Bogdzel', A.A., Data acquisition system in CAMAC standard for multiparameter experiments, 15:49305 (R;SU;In Russian)
Bogush, G.H., Evolution of surface area during the controlled growth of silica spheres, 15:48973 (R;US)
Bohlin, M., *See* Nordh, H.L., 15:49767
Bohn, T., *See* Yarema, R.J., 15:49371
Bolig, C.A., *See* Harris, P.A., 15:48378
Bolotin, Yu.L., Some dynamical properties of the linear three-particle chain, 15:50102 (R;UA;In Russian)
Bolotov, V.N., Influence of the Ore slot on the positron energy distribution function, 15:49879 (R;UA;In Russian)
Bonabian, S., *See* Mrugala, M., 15:48301
Bonche, P., Shape isomers at no spin, 15:50013 (R;FR)
Boncompain, B., *See* Massiera, M., 15:48451
Bonham, R.A., Sobre experimental aspects of electron correlation in molecules, 15:49865 (RA;BR)
Bonino, G., Flexibility of mass produced engines as shaft power and electricity conversion carriers for biomass derived fuels, 15:48430 (RA;LU)
Bontemps, A., Dynamic test of a 9m diameter wind turbine, 15:48480 (R;FR;In French)
Booker, J.R., *See* Egbert, G.D., 15:49732
Boos, E.G., Study of multiparticle correlations in 200-400 GeV range, 15:49992 (R;SU;In Russian)
Booth, A., *See* Barsotti, E., 15:49274
Booth, T.E., *See* Soran, P.D., 15:49375
Borcke, E., Speed and speed classes of film-screen systems: Determination and practical application: Tolerances, limiting values and appropriate measuring methods, 15:49683 (RA;GB)
Borek, T.T., *See* Lindquist, D.H., 15:48947
Borges, J.F.A., Determination of the stacking fault energies of face centured cubic metals and alloys by X-rays diffraction, 15:48875 (R;BR;In Portuguese)
Borges, R.C., *See* Galetti, M.R.S., 15:48550
Borghi, V.C., *See* Silva, S.R. da, 15:49693
Borisov, A.A., The neutron leakage spectrum for an iron sphere with a central 14 MeV neutron source, 15:50056 (R;XA)
See Markovskij, D.V., 15:50054

Bork, P., *See* Johnson, R.L., 15:48209
Borovsky, J.E., *See* Suszcynsky, D.M., 15:50084
Borowecki, M., Automated system of visible and ultraviolet spectroscopy for the T-15 tokamak, 15:50142 (RA;CS;In Russian)
Bossert, R.C., Mechanical support of superconducting coils, 15:49250 (R;US)
Bossoll, R.B., Laser-induced IR fluorescence spectra of simulant chemical threat agent and exhaust vapors. Technical report, 15:49408 (R;US)
Bostick, W.D., *See* Trowbridge, L.D., 15:48216
Bottimore, D.P., *See* McNelis, D.N., 15:49723
Bouchet, P., *See* Encrenaz, T., 15:49756
Boudard, A., Production of light mesons in P + D reactions, 15:49903 (R;FR)
Boukadida, T., Convergence of numerical schemes suitable for two dimensional nonlinear convection: application to the coupling of modes in a plasma, 15:50092 (R;FR;In French)
Bouldin, D.W., *See* Newport, D.F., 15:49222
Bourne, L.C., *See* Goldstein, H.F., 15:48927
Bove, L.J., *See* Mirchandani, M.G., 15:49416
Bowden, M., *See* Barsotti, E., 15:49274
See Swoboda, C., 15:49336
Bowers, C., *See* Denby, B., 15:49269
Bowersox, V.C., *See* Sisterson, D.L., 15:49457
Bowman, K.O., [International meeting of ecology]: Foreign trip report, August 20, 1990–August 30, 1990, 15:49574 (R;US)
Bowman, S.M., Validation of scale-4 for LWR [Light Water Reactor] fuel in transportation and storage cask conditions, 15:48229 (R;US)
Boyarinov, S.V., Cumulative K^--meson production by protons with energy of 10 GeV, 15:49988 (R;SU;In Russian)
Boyd, G., An integrated acid precipitation policy and energy market model, 15:48097 (R;US)
Boyd, R., Hydroelectric installations: A priceless heritage: Proceedings, 15:48445 (RA;CA)
Bozoki, E., *See* Murphy, J.B., 15:49275
Brabbs, T.A., Fuel-rich catalytic combustion: A fuel processor for high-speed propulsion, 15:49156 (R;US)
Bradley, E.C., Development of remote disassembly technology for liquid-metal reactor (LMR) fuel, 15:48579 (R;US)
Bradshaw, J., *See* Majkrzak, C.F., 15:48857
Brady, M.C., End effects in the criticality analysis of burnup credit casks, 15:48230 (R;US)
See Broadhead, B.L., 15:49160
See England, T.R., 15:49994
Braga, M., Electronic structure, hyperfine interactions, and magnetic properties for iron octahedral sulfides, 15:49881 (RA;US)
Theoretical study of the interaction of Fe, Fe^+, and FeCO with Ar, 15:49046 (RA;US)
Brain, C.R., Post-test analysis of natural circulation, flow coastdown, and pressurizer spray tests in a large four loop PWR using RELAP5/MOD2: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48553 (RA;XA)
Brainard, J.R., *See* Smith, P.H., 15:49090
Brand, P., *See* Puxley, P., 15:49806
Branthaver, J.F., *See* Mason, G.M., 15:48206
Brar, N.S., Dynamic properties of porous B_4C. Interim report, 15:49389 (R;US)
Brasche, L.J.H., *See* Buck, O., 15:48877
Brase, J., *See* Yorkey, T., 15:49652
Brashear, H.R., *See* Newport, D.F., 15:49222
Brashear, J.P., *See* Becker, A.B., 15:48136
Braylan, R.C., *See* Salzman, G.C., 15:49651
Brazas, W., *See* McWright, G., 15:49380
Brechner, R.R., *See* Singh, M., 15:49363
Brennan, A.G., Image field size and beam collimation in fluoroscopic equipment: Tolerances, limiting values and appropriate measuring methods, 15:49669 (RA;GB)
Brennan, J.G., *See* Zalkin, A., 15:49008
Brennan, J.M., *See* Alessi, J.G., 15:49239
Brennan, T.M., Radon overview, 15:48799 (BA;US)
See Fritz, I.J., 15:48974
See Stevenson, T., 15:48798
Brenner, D.S., Empirical proton-neutron interaction energies and nuclear structure, 15:50021 (R;US)
Bretscher, M.M., The ORR Whole-Core LEU Fuel Demonstration: Final report, 15:48609 (R;US)
Bretthauer, E.W., *See* McNelis, D.N., 15:49723
Brewer, J.H., *See* Kadono, R., 15:50029
See Le, L.P., 15:48923
Briand, A., *See* Autin, M., 15:48990
Bricault, P., *See* Bazin, D., 15:50003
Brickner, R.G., *See* Hiromoto, R., 15:50225
Brickstad, B., *See* Dahlberg, L., 15:48536
Bridges, J.S., *See* Drabkin, M., 15:49613
Bridgwater, A.V., Pyrolysis liquids: Problems and opportunities for utilization, 15:48426 (RA;LU)
Briesmeister, J.F., *See* Forster, R.A., 15:49376
Briggs, D.D., *See* Kent, J., 15:49322
See Rouse, F., 15:49272
See Von Zanthier, C., 15:49268
Brigham, W.E., *See* Gajdica, R.J., 15:48135
Brill, A.B., *See* Dilmanian, F.A., 15:49346
Brinker, C.J., *See* Bogush, G.H., 15:48973
Brinker, D.J., *See* Weinberg, I., 15:48459
Brinkmann, H.U., *See* Kirch, N., 15:48634
Britton, C.L., *See* Bryan, W.L., 15:49561
Britton, C.L. Jr., *See* Newport, D.F., 15:49222
Broadhead, B.L., Benchmarking of dose rate calculations for spent fuel transportation casks, 15:49160 (R;US)
Burnup credit feasibility for BWR spent fuel shipments, 15:48526 (R;US)
Broc, M., Compatibility of 316L stainless steel with the liquid alloy Pb17Li, 15:48859 (R;FR)
Brockhaus, R.D., *See* Droppo, J.G. Jr., 15:49548, 15:49583
Bromm, R.D., *See* Smith, R.A., 15:48340
Bron, C., Controlling real-time systems with parallel processes, 15:50238 (R;NL)
Brooks, B.P., Guide for the application and use of valves in power plant systems: Final report, 15:48602 (R;US)
Brosseau, G., Optimal arrangement of hydroelectric power systems: Proceedings, 15:48449 (RA;CA)
See Desroches, P., 15:48447
Broutin, P., Selective steam cracking for energy and raw materials savings: Final report, 15:48137 (R;LU)
Brown, D, The use of cover crops for the maintenance of rights-of-way vegetation: A survey of the literature on succession, cover crops competition and trees, 15:48677 (R;CA)
Brown, D., *See* Edelstein, N., 15:49019
Brown, D.R., *See* Drost, M.K., 15:48496
Brown, G.M., Stable isotope labels for DNA sequencing and mapping, 15:49647 (BA;US)
Thermal and laser assisted conversion of metallo-organic precursors to ceramic materials, 15:48936 (BA;US)
Brown, J.K., *See* Harris, C.B., 15:49036, 15:49037
Brown, M.J., The e-beam sustained CO_2 laser amplifier, 15:49213 (RA;US)
Brown, R.C., Load turndown in a two-bed fluidized combustor, 15:48116 (R;US)
Simulation of alpha continuous air monitor alarm response in the presence of plutonium, 15:49557 (R;US)
See Foley, J.E., 15:48114
See Pflum, D.L., 15:48115
Brown, S.D., *See* Homeny, J., 15:48906
Brown, S.M., *See* Droppo, J.G. Jr., 15:49547
Brown, T.D., *See* Harris, P.A., 15:48378
Brownell, G.L., *See* Stearns, C.W., 15:49351
Bruijn, T.J.W. de, The CANMET [Canada Centre for Mineral and Energy Technology] emulsion upgrading process, 15:48195 (RA;CA)
Brunner, J., Determination of value of the $\sigma(\nu\text{-barn}\rightarrow\mu^{\pm}X)\sigma(\nu\text{-barp}\rightarrow\mu^{\pm}X)$ cross section ratio at neutrino energies up to 30 GeV, 15:49928 (R;SU;In Russian)
Brunson, G.S., *See* Arnone, G.J., 15:49337
Bruschi, M., *See* Bertin, A., 15:50201
Brush, L.H., Preliminary model of repository chemistry for the Waste Isolation Pilot Plant, 15:48288 (R;US)

Bryan, S.A., *See* Moyer, B.A., 15:49088
Bryan, W.L., Advantages of a modular design approach for radiological instrumentation, 15:49561 (J;US)
See Newport, D.F., 15:49222
Bryant, H.J., *See* Abbrecht, P.H., 15:49410, 15:49411
Bryushinkin, S.M., Unified geometric theory of gravitation and electromagnetism: 5. Gravitational collapse and scalar radiation, 15:49810 (R;SU;In Russian)
Buchanan, R.C., *See* Armstrong, T.R., 15:48945
Bucher, R.G., *See* Persiani, P.J., 15:48388
Buck, J.W., *See* Droppo, J.G. Jr., 15:49547, 15:49548, 15:49583
Buck, O., Deducing mechanical properties due to interfaces from their acoustical response, 15:48877 (R;US)
Fatigue crack characterization by ultrasonic inspection, 15:49189 (R;US)
See Thompson, R.B., 15:48919
Buckius, R.O., *See* Peters, J.E., 15:48121
Buckley, B.T., *See* Ramsey, J.M., 15:49872
Budiansky, B., Theory of ceramic/zirconia composites: Toughening, strengthening, and synergism, 15:48904 (R;US)
Bugarya, V.I., VUV spectroscopy in the T-15 tokamak, 15:50140 (RA;CS;In Russian)
Bugg, F., *See* Clem, W.L., 15:48324
Bukharbaev, K.S., Currents caused by radiation-induced defects in p-n junctions: 2. Solid state physics and mass transfer simulation, 15:50082 (RA;SU;In Russian)
Buleeva, N.N., *See* Badikov, S.A., 15:49999
Bullen, D.B., BWR [Boiling Water Reactor] Owners Group Intergranular Stress Corrosion Cracking Research Program: Executive summary: Phase 2 (1984–1988): Final report, 15:48528 (R;US)
Buller, J.F., *See* Klein, V.F., 15:49367
Bullock, R.L., Smoothwall blasting planned for the underground research facility at Yucca Mountain: Volume 1, 15:48298 (BA;US)
Bunk, W., *See* Schulte, K., 15:48908
Burch, W.D., The search for advanced remote technology in fast reactor reprocessing, 15:48224 (R;US)
Burchett, K.L., *See* Brown, G.M., 15:49647
Burdik, C., *See* Bardin, D.Yu., 15:49949
Burke, F.P., *See* Winschel, R.A., 15:48076
Burke, J.M., *See* Noblett, J.G., 15:48514
Burke, L.D., Development of a high performance air cathode for the direct methanol/air fuel cell: Final report, 15:48761 (R;LU)
Burkes, T.R., *See* Cravey, W.R., 15:49220
Burmester, C.P., In-situ transmission electron microscopy and computer simulation study of the kinetics of oxygen loss in $YBa_2Cu_3O_z$, 15:48932 (R;US)
Burnet, G., Experimental studies of the production of lightweight aggregate from fly ash/coal cleaning refuse mixtures, 15:48094 (R;US)
The stabilization and utilization of coal solid wastes, 15:48095 (R;US)
Burns, C.J., $(Me_5C_5)_2Yb(\mu\text{-}H_3B)(PMe_3)$: A complex with a near-linear BH_3 bridging group, 15:49016 (RA;US)
Reaction of $(Me_5C_5)_2Yb$ with fluorocarbons: Formation of $(Me_5C_5)_4Yb_2(\mu\text{-}F)$ by intermolecular C-F activation, 15:49017 (RA;US)
Burns, D.M., Climate change and US water resources, 15:49434 (RA;US)
Burns, J.H., Synthesis and crystal structure of a lariat ether complex: Sodium SYM-(dibenzo-14-crown-4) methyl phenyl phosphinate pentahydrate, 15:49087 (BA;US)
Burrows, A., Axions and SN 1987A: Axion trapping, 15:49824 (R;US)
Bursten, B.E., *See* Strittmatter, R.J., 15:49028
Burtebaev, N.T., Cross sections of scattering of ^3He ions and α-particles with 12-20 MeV/nucleon energy on the light nuclei, 15:49989 (R;SU;In Russian)
Busarow, K.L., Tunable far-infrared laser spectroscopy of van der Waals bonds: Extended measurements on the lowest Σ bend of ArHCl, 15:49000 (RA;US)
Tunable far-infrared laser spectroscopy of van der Waals bonds: Extended measurements on the lowest Σ bend of ArHCl, 15:49136 (RA;US)
See Cohen, R.C., 15:49047, 15:49139
Buscheck, T.A., *See* Ramirez, A.L., 15:48332
Bush, B., *See* Chakrabarti, S., 15:49361
Bush, D.M., Terrestrial nickel/hydrogen battery evaluation, 15:48468 (R;US)
Bussoletti, E., *See* Colangeli, L., 15:49754
Busson, C., *See* Broutin, P., 15:48137
Bustin, R.M., Petroleum source rock characteristics of the Tertiary Skonun Formation, Queen Charlotte Islands, Hecate Strait and Queen Charlotte Sound, British Columbia, 15:48126 (RA;CA)
Stratigraphy, sedimentology and petroleum source rock potential of the Georgia Basin, southwest British Columbia and northwest Washington State, 15:48129 (RA;CA)
See Hunt, J.A., 15:48127
Butenhoff, T.J., Hydrogen-atom tunneling in the thermal tautomerism of porphine imbedded in a n-hexane matrix, 15:49127 (RA;US)
Butler, M.A., Micro-mirrors for gas sensing, 15:49388 (BA;US)
See Ewing, R.I., 15:49357
Buttermore, W., *See* Brown, R.C., 15:48116
See Foley, J.E., 15:48114
Buzulutskov, A.F., Application of the high-current wire photodetector for Cherenkov radiation ring detecting: Recent progress and future development, 15:49297 (R;SU;In Russian)
Buzzi, J.M., *See* Doucet, H.J., 15:50111
Bychkov, V.M., Nuclear reaction cross sections recommended as the standards for neutron measurements, 15:49981 (R;SU;In Russian)
See Manokhin, V.N., 15:49985
Byong-Hun, Ahn, Korea's energy policy and its environmental implications, 15:49451 (RA;US)
Byrd, R.C., *See* Taddeucci, T.N., 15:50000
Bywater, R.L., Command validation of secondary EM [electromagnetic] pump system in the EBR-II [Experimental Breeder Reactor-II], 15:48611 (R;US)

C

Cable, S., *See* Tajima, T., 15:49749
Cadoff, H.Y., *See* Williams, J.R., 15:48327
Cahill, P.A., Chemistry of anomalous-dispersion phase-matched second harmonic generation, 15:49084 (BA;US)
Calzergues, R., A 600 m^3 stratified thermal storage using sensible heat on the saclay nuclear research site (France), 15:48687 (R;FR;In French)
Calan, C. de, Generalized radiative corrections for hadronic targets, 15:49922 (R;FR;In French)
Caldwell, D., *See* Cavalli-Sforza, M., 15:49359
Caley, C.E., *See* Moyer, B.A., 15:49088
Camous, F., Analysis of reactivity accidents in PWR'S, 15:48541 (R;FR)
Camp, D.E., *See* Haskins, P.S., 15:49362
Campana, M., Irradiation program of the transuranium European institute in the HFR reactor, 15:48633 (RA;FR;In French)
Campbell, K., *See* Birdsell, K.H., 15:48308
Campbell, M., *See* Denby, B., 15:49269
Campbell, M.H., *See* Chacey, K.A., 15:48351
Campos, Aguilar, A., *See* Prieto, M., 15:49804
Cann, D., SISAL versus FORTRAN: A comparison using the Livermore Loops: Revision 2, 15:50242 (R;US)
Cao, N., *See* Drukier, A.K., 15:49201
Capone, D.G., Direct determination of nitrification in marine waters by using the short-lived radioisotope of nitrogen, ^{13}N, 15:49639 (J;US)
Cappiello, M.W., *See* Rider, W.J., 15:48577
Capponi, M., *See* Bertin, A., 15:50201
Carballada, L., *See* Desroches, P., 15:48447
Carey, T.A., *See* Taddeucci, T.N., 15:50000
Carithers, W.C., *See* Haber, C., 15:49273
Carlson, J.H., Opportunities: Volume 1, 15:48356 (BA;US)
Carlson, R., *See* Ramirez, A.L., 15:48332
Carlson, T.A., *See* Lindle, D.W., 15:49132
Carnahan, C.L., Simulation on reactive chemical transport in varying thermal field with reaction-flow coupling: Volume 1, 15:48306 (BA;US)

Carnal, C.L., Consolidated fuel reprocessing program simulation of a continuous rotary dissolver, 15:48226 (BA;US)
Caro, J.A., The stability of irradiation-induced defects in NiAl, 15:48864 (R;US)
Carpenter, M.P., *See* Khoo, T.L., 15:50011
Carpite, N.C., *See* Gibeaut, D.M., 15:49649
Carr, P., Analysis of uncertainties in environmental loading on offshore structures, 15:49196 (R;GB)
Carreras, B.A., *See* Harris, J.H., 15:50132
See Ritz, C.P., 15:50112
Carrigan, C.R., The dynamics of magma transport and eruption processes: An overview of recent developments, 15:49743 (R;US)
Carroll, K., *See* Drukier, A.K., 15:49201
Carstens, D.H.W., An apparatus for studies of hydrogen isotope exchange over metals using laser-Raman spectroscopy, 15:48998 (R;US)
Carswell, R.F., *See* Espey, B.R., 15:49799
Cartiglia, N., *See* Ziock, H.J., 15:49374
Case, F.I., *See* Moyer, B.A., 15:49088
Case, G.N., *See* Moyer, B.A., 15:49088
Casey, M.E., *See* Strother, S.C., 15:49350
Casini, G., Joint research centre fusion materials irradiations in HFR: Present status and prospectives, 15:50173 (RA;FR)
Casner, S., *See* Katz, A., 15:50209
Casteel, W.J. Jr., *See* Zemva, B., 15:49099
Casten, R.F., Axial asymmetry and the IBM, 15:50018 (R;US)
Effects of the residual proton-neutron interaction in the development of collectivity in nuclei, 15:50020 (R;US)
The proton-neutron residual interaction in nuclear structure, 15:50019 (R;US)
See Brenner, D.S., 15:50021
Castor, J.I., *See* Poe, C.H., 15:49847
Cates, C., *See* Ball, A.H., 15:49331
Caulton, K.G., *See* Van Der Sluys, L.S., 15:49092
Cavalli-Sforza, M., Construction and testing of the SLD Cerenkov ring imaging detector, 15:49359 (J;US)
Cavallin, C., *See* Lobner, P., 15:48539
Cavata, C., Charged pion production in nucleus-nucleus collisions AT E/A between 400 and 800 MeV, 15:49982 (R;FR;In French)
Charged pion production in nucleus-nucleus collisions at E/A between 400 and 800 mev, 15:50007 (R;FR;In French)
Cavedon, J.M., *See* Platchkov, S., 15:49904
Ceccarelli, C., Herbig Ae/Be stars: fine structure far-infrared lines: Proceedings of the 22. Eslab Symposium, 15:49781 (RA;FR)
Celik, I., Deposition, corrosion, erosion and sulfur emission studies related to coal combustion: Annual report, 15:48109 (R;US)
Celmaster, W., Parallelization of a radiation transport simulation code on the BBN TC2000™ parallel computer, 15:49285 (R;US)
Chacey, K., DOE-EM/producers strategy for wasteform and process startup acceptance: Volume 1, 15:48326 (BA;US)
See Ketola, W.S., 15:48325
Chacey, K.A., The technical review group: An application of the quality assurance program descriptions for defense high-level waste processing: Volume 1, 15:48351 (BA;US)
Chakraborti, S., Remote sensing of the thermosphere, plasmasphere, and exosphere, 15:49361 (J;US)
Chamberlin, J.L., *See* Murty, V.S., 15:48460
Chambre, P.L., *See* Hwang, Y., 15:48304
See Zwahlen, E.D., 15:48380
Chan, A.M.C., Wind force measurement on a model fuelling-machine trolley in a simulated LOCA, 15:48661 (R;CA)
Chan, C.Y., *See* Cooley, C.R., 15:48371
Chang, F., Important design considerations for heavy oil plants, 15:48193 (RA;CA)
Chang, H.L.M., Epitaxial TiO_2 and VO_2 films prepared by MOCVD [metal-organic chemical vapor deposition], 15:48915 (R;US)
Chang, S.L., Three-dimensional computer simulation of non-reacting jet-gas flow mixing in an MHD second stage combustor, 15:48107 (R;US)
See Lottes, S.A., 15:48106
Chang, Y.T., *See* Miller, W.H., 15:50229
Chantrenne, S., *See* Hutton, R., 15:49889
Chapellier, M., *See* Bernier, M.E.R., 15:49867
Chapman, R.L., *See* Kouts, C.A., 15:49174
Charlton, L.A., *See* Harris, J.H., 15:50132
Charron, D., Radiofrequency radiation in the workplace, 15:49728 (R;CA)
Chartas, G., *See* Sprott, J.C., 15:50115
Chasman, R.R., Superdeformation in the mercury region, 15:50022 (R;US)
See Khoo, T.L., 15:50011
Chateauneuf, J.E., Direct measurement of the absolute kinetics of chlorine atom in CCl_4, 15:49093 (BA;US)
Chatelard, P., ICARE, a computer code for severe fuel damage analysis - General description of the second version, ICARE2: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48534 (RA;XA)
Chatmon-McEaddy, M., *See* Paintal, A.S., 15:49485
See Rosengrant, L., 15:49482, 15:49483, 15:49487, 15:49488, 15:49489, 15:49497
Chatterjee, L., Phase space, meson exchange and the photon connection in sticking, 15:50195 (RA;GB)
Chatterji, P.K., *See* Kack, G.J., 15:48498
Chekanov, N.A., *See* Bolotin, Yu.L., 15:50102
Chemtob, M., Effective methods in QCD and the phenomenology of hadrons, 15:49920 (R;FR)
Chen, C.H., Laser applications for high-T_c superconductors, 15:49206 (R;US)
Chen, F.C., Performances of four magnetic heat-pump cycles, 15:49161 (R;US)
See Ho, C.M., 15:48805
Chen, G., *See* Kraiman, J.B., 15:50189
Chen, G.L., *See* Chen, F.C., 15:49161
Chen, M.H., *See* Hutton, R., 15:49889
Chen, S.S., Unsteady fluid forces and fluidelastic vibration of a group of circular cylinders, 15:49177 (R;US)
Chen, Yinchao, *See* Simpson, T.L., 15:49219
Cheng, B., Hydrogen water chemistry fuel surveillance at Dresden-2, 15:48530 (R;US)
Cheng, L., *See* Wong, R.K.W., 15:49455
Cheng, Y.S., *See* Mauderly, J.L., 15:49721
Chernakova, A., *See* Korenev, S.A., 15:50078
Chernikov, N.A., Tensor lost in general relativity theory, 15:50100 (R;SU;In Russian)
The energy problem in GR and tensor analysis, 15:50099 (R;SU;In Russian)
Chernyj, N.A., *See* Mal'tsev, I.G., 15:49254
Chesler, D.A., Calibration of detector sensitivity in positron cameras, 15:50064 (J;US)
See Stearns, C.W., 15:49351
Chesnel, A., *See* Camous, F., 15:48541
Chia, V.K.F., Ultrahigh-vacuum apparatus for surface spectroscopy and characterization at cryogenic temperatures, 15:49282 (RA;US)
See Veirs, D.K., 15:49076
Chiang, Shan-Hsin, Report of working group B: Priorities for research in agriculture and forestry, 15:49436 (RA;US)
Chiang, W.H., *See* Ryu, D., 15:49838
Chiao, P., *See* Hutchins, G.D., 15:49349
Chieze, J.P., *See* Lioure, A., 15:49747
Chikhraj, E.V., *See* Abdullin, Kh.A., 15:50083
Childress, P.C., *See* McGuinn, E.J., 15:49172
Chiles, M.M., Multi-energy neutron detector for counting thermal neutrons, high-energy neutrons, and gamma photons separately, 15:49364 (J;US)
See McElhaney, S.A., 15:49564
Chini, R., *See* Tuffs, R.J., 15:49791
Chisholm, M.F., *See* Pennycook, S.J., 15:48952
Chistyakov, Y.D., *See* Glazov, V.M., 15:48856
Chittenden, D.H., Thin-film composite materials, Phase 2. Final report, 1 April-31 December 1986, 15:48948 (R;US)
Cho, G., Assessment of TFT amplifiers for a-Si:H PIXEL particle detectors, 15:49356 (J;US)
See Fujieda, I., 15:49324
Cho, H.-R., The role of clouds and precipitation in the long-range transport of air pollutants and acid rain formation in Canada: Phase 2. Programming, testing and refining of cloud dynamics, microphysics and chemistry models, 15:49473 (R;CA)

Choi, D.I., *See* Kim, Jin-Yong, 15:50119
Choppin, G.R., *See* Stout, B.E., 15:49033
Chou, W.T., *See* Brenner, D.S., 15:50021
Chriss, N., *See* Denby, B., 15:49269
Christensen, M., IGES efficiency evaluation, 15:50244 (R;US)
Christian, D., *See* Swoboda, C., 15:49336
Christianson, C.C., *See* Patil, P.G., 15:48838
Christova, P.Ch., *See* Bardin, D.Yu., 15:49949
Chu, Tze Yao, *See* Hickox, C.E., 15:48478
Chubisov, M.A., *See* Fajn, V.Eh., 15:50058
Chulkov, L.V., *See* Mukha, I.G., 15:50027
Chumbley, L.S., *See* Schwartzkopf, L.A., 15:48918
Chung, F., Report of working group C: Priorities for research in energy policies, 15:49431 (RA;US)
Chung, F.M.K., Energy consumption and generation of greenhouse gases in Hong Kong, 15:49447 (RA;US)
Churin, E., Catalytic treatment of pyrolysis oils, 15:48435 (R;LU)
Characterization and upgrading of pyrolytic oils, 15:48425 (RA;LU)
Chuvatin, S.A., *See* Gryzgunov, V.A., 15:50137
Chuvilin, D.Yu., *See* Borisov, A.A., 15:50056
Ciez, A.P., *See* Nair, B.R., 15:49170
Ciskowski, D.E., *See* Taddeucci, T.N., 15:50000
Clancy, P.W., *See* Logg, C.A., 15:49271
Clark, D.E., *See* Wicks, G.G., 15:48319
Clarke, J., SQUIDs: Principles, noise and application, 15:49221 (BA;US)
Clarkin, M.E., Radon I: Sources and assessment, 15:48800 (BA;US)
Radon II: Mitigation, 15:48801 (BA;US)
Clayton, N., Electron-impact ionization of U^{88+} - U^{91+}, 15:49916 (RA;US)
Clem, J.R., Granular and superconducting-glass properties of the high-temperature superconductors, 15:48920 (R;US)
See Finnemore, D.K., 15:48921
Clem, W.L., Simulation modeling of subsurface development: Volume 1, 15:48324 (BA;US)
Clement, J.A., *See* Kinner, N.E., 15:49633
Clements, R.E., *See* Tao, W.C., 15:49395
Clerc, H.G., *See* Gaimard, J.J., 15:50006
Clifft, B.E., *See* Bogaty, J.M., 15:49241
Cloke, F.G.N., *See* Anderson, D.M., 15:49063
Cloninger, M.O., *See* Stahl, D., 15:48321
Clough, P.N., *See* Keir, D., 15:48650
Cloutis, E.A., A new analytical technique for the comprehensive characterization of oil sands: Reflectance spectroscopy, 15:48201 (RA;CA)
Coates, J.H., Compared economic features of enrichment processes: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988, 15:48249 (RA;XA)
Coates, L., *See* Fuhr, B.J., 15:48174
Coche, J.C., *See* Caizergues, R., 15:48687
Coderre, J.A., *See* Dilmanian, F.A., 15:49346
Coelho, S.V., *See* Duarte Neto, J., 15:48212
Cohen, J.M., *See* Hock, S.M., 15:48483
Cohen, J.S., Cold fusion and tritium, 15:50199 (RA;GB)
Cohen, M.L., Novel properties of matter at megabars of pressure, 15:50086 (RA;US)
See Knittle, E., 15:49079
See Zhang, S.B., 15:50085
Cohen, R.C., Tunable far-infrared laser spectroscopy of van der Waals bonds: Vibrational-rotation-tunneling spectra of Ar-H_2O, 15:49047 (RA;US)
Tunable far-infrared laser spectroscopy of van der Waals bonds: Vibration-rotation-tunneling spectra of Ar-H_2O, 15:49139 (RA;US)
See Blake, G.A., 15:49048
See Busarow, K.L., 15:49000, 15:49136
Colangeli, L., The unidentified IR bands in laboratory, in interstellar medium and in comets: Proceedings of the 22. Eslab Symposium, 15:49754 (RA;FR)
Colchin, R.J., *See* Harris, J.H., 15:50132
Cole, C.W., Design criteria for produced sand injection facilities, 15:48205 (RA;CA)
Cole, D.A., *See* Fowkes, F.M., 15:48084, 15:48085
Cole, D.R., Isotope geochemistry: A critical component of energy research, 15:49739 (R;US)
Coles, G.A., *See* Wang, O.S., 15:48669
Collard, L.B., *See* Wang, O.S., 15:48669
Collinet, J., Dispositions taken in France to limit gaseous releases from PWR power plants in abnormal operating conditions, 15:48540 (R;FR)
Collins, P.M., *See* Suggett, J., 15:48197
Colmer, J.D., *See* Ball, A.H., 15:49331
Colturato, M.T., *See* Barboza, M.F. de, 15:49148
Combes, F., *See* Encrenaz, Th., 15:49755
Come, B., CEC project Mirage - Second phase on migration of radionuclides in the geosphere: Second summary progress report (Work period 1988), 15:49734 (R;FR)
Comnes, G.A., *See* Kahn, E., 15:48751
Conaway, J.G., *See* Hearst, J.R., 15:49401
Conca, J.L., Diffusion barrier transport properties of unsaturated paintbrush tuff rubble backfill: Volume 1, 15:48314 (BA;US)
Condon, J.B., *See* Kirkpatrick, J.R., 15:48883
Conklin, J.C., Tubeside evaporation of nonazeotropic refrigerant mixtures from two enhanced surfaces, 15:48773 (R;US)
See Granryd, E., 15:48772
Connelly, M.P., *See* Rockhold, M.L., 15:48347
Connick, R.E., Formation of oxyacids of sulfur from SO_2, 15:49051 (RA;US)
Connor, C., The practical challenges of converting end-use data into information, 15:48795 (R;US)
Conradi, M.S., *See* Baker, D.B., 15:50076
Constant, R.J., Radioisotopes production programmes for reactor radioisotopes, 15:48636 (RA;FR)
Conti, M., *See* Cho, G., 15:49356
See Del Guerra, A., 15:49353
See Fujieda, I., 15:49324
Continetti, R.E., Symmetric stretch excitation of CH_3 in the 193.3-nm photolysis of CH_3I, 15:49137 (RA;US)
See Robinson, G.N., 15:49882, 15:49883, 15:49884
See Zhao, X., 15:49141
Contreras, R., Local dielectric effects and the calculation of thermodynamic functions of ion solvation within a born continuum approach, 15:49032 (RA;BR)
Contreras, R.H., Electronic origins of NMR parameters, 15:50066 (RA;BR;In Spanish)
Conway, J.G., *See* Blaise, J., 15:49021
See Williams, G.M., 15:49023
Cook, A.J., A desk study of surface diffusion and mass transport in clay, 15:48276 (R;FR)
Cook, J.J., *See* Lyle, M.C., 15:48780
Cook, N.G.W., *See* Meyer, L.R., 15:48343
Cook, W.J., Simultaneous particulates NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 2, October 1, 1987–December 31, 1987, 15:48504 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 1, July 15, 1987–October 1, 1987, 15:48503 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 3, January 1, 1988–March 31, 1988, 15:48505 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 4, April 1, 1988–June 30, 1988, 15:48506 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 5, July 1, 1988–September 30, 1988, 15:48507 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 6, October 1, 1988–December 31, 1988, 15:48508 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemcial technology: Technical progress report No. 7, January 1, 1989–March 31, 1989, 15:48509 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 8, April 1, 1989–June 30, 1989, 15:48510 (R;US)

Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 9, July 1, 1989–September 30, 1989, 15:48511 (R;US)
Cooley, C.R., High-level radwaste plans in nine countries, 15:48371 (J;US)
Spent fuel and high-level waste management in selected countries: Trends and issues: Volume 1, 15:48346 (BA;US)
Cooper, M., *See* Yasillo, N.J., 15:49348
Cooper, M.D., Nuclear medicine and imaging research (quantitative studies in radiopharmaceutical science): Progress report, January 1–September 1, 1990, 15:49688 (R;US)
See Beck, R.N., 15:49687
Cooper, S.D., *See* Pellizzari, E.D., 15:49538
Copeland, E.J., Classical theory of radiating strings, 15:49823 (R;GB)
See Barrow, J.D., 15:49818
Copeman, T.W., *See* Harvey, A.H., 15:50232
Coppock, R., *See* Chung, F., 15:49431
Coquille, J.P., *See* Caizergues, R., 15:48687
Corio, M.R., Estimating the effect of generating unit age on EFOR [equivalent forced outage rate] and EAF [equivalent availability factor] for coal-fired steam units operating between 1964 and 1981, 15:48485 (R;US)
Cornell, L.P., *See* Cook, W.J., 15:48510, 15:48511
Cornelia, R.J., *See* Persiani, P.J., 15:48388
Cornille, M., *See* Jacquemot, S., 15:50110
Corso, J., *See* Nieves, L.A., 15:48255
Corte, P., *See* Vergnet, L., 15:48424
Costa, I., Separable coordinates and particle creation III: Accelerating, Rindler and Milne vacua, 15:49962 (R;BR)
Cotton, D., *See* Chakrabarti, S., 15:49361
Cotton, T.A., Current social systems issues in the U.S. high level waste management program: Volume 1, 15:48322 (BA;US)
Cottrell, W.D., *See* Swaja, R.E., 15:49575
Coudrain-Ribstein, A., *See* Vinsot, A., 15:48271
Coughtrey, P.J., Incorporation of experimental data, review and documentation of the SPADE database, 15:49711 (R;GB)
Courant, E.D., *See* Lee, S.Y., 15:49230
Court, S.J., U.S. regulatory environment, 15:48738 (RA;CA)
Cousins, T., Pulse-width dependent radiation effects on electronic components. Technical Note No. 89-33, 15:49399 (R;CA)
Covinsky, M.H., *See* Weiss, P.S., 15:49138, 15:49885
Cowdery, C.C., *See* Reed, B., 15:48423
Cowen, A.R., *See* Workman, A., 15:49672
Cox, P., *See* Jourdain de Muizon, M., 15:49784
Cox, P.A., *See* Anderson, D.M., 15:49063
Cox, S.F.J., *See* Belushkin, A.V., 15:50079
Coyle, P., *See* Cavalli-Sforza, M., 15:49359
Coyne, D., *See* Cavalli-Sforza, M., 15:49359
Cozzolino, C., *See* Xia, W., 15:48951
Crabol, B., *See* Manesse, D., 15:48639
Cragg, C.B, Canada Brick Quarry ash landfill. Groundwater monitoring and control system modifications, 1989, 15:49604 (R;CA)
Cragg, C.B.H., A statistical comparison of uplift design methods for augered footings in sand, 15:48970 (R;CA)
Cralevich, A.F., Study of the silica aerogel densifications by SAXS and BET, 15:48909 (R;BR;In Portuguese)
Craig, R., *See* Rosengrant, L., 15:48147, 15:49476, 15:49516, 15:49517, 15:49518, 15:49519, 15:49520, 15:49521, 15:49522, 15:49523, 15:49524, 15:49525, 15:49526, 15:49527, 15:49528, 15:49529, 15:49530, 15:49577, 15:49607, 15:49608
Craig, R.M., *See* Rosengrant, L., 15:49492, 15:49493, 15:49494
Cramp, T.J., Assessment of the agricultural implications of land burial of radioactive wastes: soil processes, 15:48256 (R;GB)
See Coughtrey, P.J., 15:49711
Crane, G., *See* Logg, C.A., 15:49271
Cravey, W.R., A hybrid pulse forming technique, 15:49220 (R;US)
Crawford, J.E., *See* Le Blanc, F., 15:50073
Crawford, R.K., A fast large-area position-sensitive time-of-flight neutron detection system, 15:49320 (J;US)
Crawley, H.B., *See* Gorbics, M.S., 15:49281
Creagh, A.L., *See* Rodgers, P.A., 15:49065
Creighton, A.J.A., *See* Kerby, M.C., 15:49055
Crocker, R.W., Structural changes of oxide films during anodization of p-doped silicon in aqueous ammonium fluoride, 15:48696 (RA;US)
Cromwell, E., Ultranarrow-bandwidth vacuum ultraviolet (VUV)-XUV laser system, 15:49140 (RA;US)
See Trickl, T., 15:49886
Crovisier, J., Infrared cometary spectroscopy: Proceedings of the 22. Eslab Symposium, 15:49752 (RA;FR)
Crowe, B.M., Basaltic volcanic episodes of the Yucca Mountain region: Volume 1, 15:48296 (BA;US)
Crowson, P.C.F., Uranium: The recalcitrant commodity: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988, 15:48253 (RA;XA)
Crume, E.C., *See* Harris, J.H., 15:50132
Cucinotta, F.A., *See* Wilson, J.W., 15:49716
Cullen, W.H., Proceedings of the third International Atomic Energy Agency specialist's meeting on subcritical crack growth: Opening session and Technical session 1, 15:48537 (R;US)
Proceedings of the third International Atomic Energy Agency specialists' meeting on subcritical crack growth: Technical sessions 2, 3, and 4 and Recommendations and conclusions Session 5, 15:48538 (R;US)
Cummings, A., *See* Shutt, T., 15:49344
Cunningham, M., *See* Kinch, R., 15:49503, 15:49511
Curcio, L.A. Jr., *See* Somerscales, E.F.C., 15:49180
Curry, R.G., *See* Kahler, J.P., 15:49415
Curtis, D.B., *See* Cole, D.R., 15:49739
Curtis, L.A., *See* Denning, R.S., 15:48663
Curtis, L.J., Semiempirical studies of atomic structure: Progress report, July 1, 1990–June 30, 1991, 15:49874 (R;US)
Cutler, P.D., *See* Guerrero, T.M., 15:49699
See Hoffman, E.J., 15:49701
Cybulskis, P., *See* Denning, R.S., 15:48663
Czirr, J.B., *See* Jones, S.E., 15:50200
Czok, M., Progress in the theory of non-linear chromatography, 15:49026 (BA;US)

D

D'Agostino, P.A., Analysis of soil samples for chemical warfare agents: Canadian contribution to a multinational round-robin analytical exercise. Memorandum report, 15:49409 (R;US)
d'Hendecourt, L.B., *See* Leger, A., 15:49766
See Verstraete, L., 15:49774
D'yachenko, V.M., Monitoring system for relativistic particles and nuclei, 15:49260 (R;SU)
Dabrowski, B., Superconducting and structural properties of the $(Ba_{0.6}K_{0.4})$ $(Bi_{1-y}Sb_y)O_3$ system, 15:48910 (R;US)
Dagle, J.E., *See* De Steese, J.G., 15:48497
Dahlberg, L., R and D projects in reactor technology at the Swedish Plant Inspectorate (SA): Summary report, 15:48536 (RA;XA)
Dahlbom, M., *See* Digby, W.M., 15:49347
See Guerrero, T.M., 15:49699
Dahmen, U., Novel materials from nanocrystalline aggregates, 15:48888 (RA;US)
TEM characterization of nanocrystals produced by decomposition reactions, 15:48929 (RA;US)
The use of heteroepitaxy in the fabrication of bicrystals for the study of grain-boundary structure, 15:49080 (RA;US)
Dai, T.S., Current reclamation approach at the syncrude oil sands plant: Volume 2, 15:48208 (RA;CA)
Daily, W., *See* Ramirez, A.L., 15:48332
Dajkovskij, A.G., *See* Abramov, A.G., 15:49256
Dalgarno, A., The physics of electronic and atomic collisions, 15:49868 (B;US)
Daling, P.M., A literature-based preliminary characterization of risks in the nuclear waste management system: Volume 1, 15:48386 (BA;US)
Dalland, M., *See* Hanssen, J.E., 15:48134
Daly, P.J., *See* Khoo, T.L., 15:50011
Damdinsurehn, Ts., *See* D'yachenko, V.M., 15:49260
Damgaard, P.H., Symmetries of Chern-Simons theory in Landau gauge, 15:49958 (R;BR)

Damiano, B., Calculation of BWR [Boiling Water Reactor] limit cycle amplitude using Galerkin's method, 15:48527 (R;US)
Dance, D.R., *See* Fitzgerald, M., 15:49675
Danese, F.L., Size and transportation capabilities of the existing U.S. cask fleet: Volume 1, 15:48241 (BA;US)
See Best, R.E., 15:48237
See Grady, S.T., 15:48238
Danielson, E., *See* Worl, L.A., 15:49143
Danker, W.J., The systems integration modeling system: Volume 1, 15:48367 (BA;US)
Danos, M., Accuracy-weighted variational principle for degenerate continuum states, 15:50192 (RA;GB)
Danziger, I.J., *See* Oliva, E., 15:49770, 15:49787
Darleston, B.J., A review of the UK PWR structural integrity and materials programme: Summary report, 15:48565 (RA;XA)
Darrough, M., Accident analysis in fulfillment of the requirements of the national environmental policy act and their relationship to the packaging and testing requirements of the Nuclear Regulatory Commission: Volume 1, 15:48385 (BA;US)
Darwin, D.C., Rate constants for $^3CH_2$ (X^3B_1) removal by O_2, NO, and C_2H_2 from infrared-diode laser flash kinetic spectroscopy, 15:49039 (RA;US)
Datskou, I., *See* Payne, M.G., 15:49871
Datta, S., Manifolds, tensors and differential forms: some applications in physics, 15:50090 (R;IN)
Daum, P.H., Problems in aircraft measurement of trace atmospheric species, 15:49559 (BA;US)
Dauskardt, R.H., *See* Veirs, D.K., 15:49077
Davidson, R.F., *See* Maudlin, P.J., 15:48886
Davies, J.D., Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989, 15:50182 (R;GB)
The non-observation of cold nuclear fusion in electrolytic cells stimulated by high intensity stopped muons and pions, 15:50198 (RA;GB)
See Cohen, J.S., 15:50199
Davies, M., *See* Faulkner, K., 15:49663
Davis, C.B., *See* Shaw, R.A., 15:48659
Davydov, L.N., *See* Akhiezer, I.A., 15:48959
Dawson, L.R., *See* Jones, E.D., 15:48976
Day, B.W., *See* Jankowiak, R., 15:49646
Dayal, R., Reactor operating waste-disposal program: 1989 progress report, 15:48285 (R;CA)
de Caumia, B., *See* Lemieux, R.R., 15:48421
De Jonghe, L.C., Electrochemical properties of solid electrolytes, 15:49110 (RA;US)
See Liu, M., 15:49111, 15:49113
See Visco, S.J., 15:49112
de Pablo, J.J., Thermodynamics of liquid-liquid equilibria including the critical region, 15:49157 (RA;US)
De Pascalis, G., *See* Del Guerra, A., 15:49353
De Steese, J.G., Electric utility benefits of superconducting magnetic energy storage, 15:48497 (R;US)
Dearborn, D., *See* Salati, P., 15:49848
Debbe, R., A study of wire chambers with highly segmented cathode pad readout for high multiplicity charged particle detection, 15:49323 (J;US)
Decker, D.L., *See* Jones, S.E., 15:50200
Dederer, J.T., *See* Wu, J.L., 15:49205
DeFord, J.F., *See* Shang, C.C., 15:49237
Defourneau, D., *See* Verstraete, L., 15:49774
Dehli, M., Economic utilization of landfill gas from small and medium-sized waste dumps: Demonstration project: Final report, 15:48829 (R;LU;In English, German)
DeJonghe, L.C., *See* Rahaman, M.N., 15:48984
DeKalb, E.L., *See* Edelson, M.C., 15:48995
Del Guerra, A., Test of the HISPET prototype, 15:49353 (J;US)
Del Moral, R., *See* Bazin, D., 15:50003
See Gaimard, J.J., 15:50006
See Hubert, F., 15:50002
Delagrange, H., *See* Hubert, F., 15:50002
Delene, J.G., Updated comparison of economics of fusion reactors with advanced fission reactors, 15:50168 (R;US)
Delis, D., *See* Moretto, L.G., 15:50001
Delmon, B., *See* Churin, E., 15:48425
DeMaat, R., *See* Swoboda, C., 15:49336
Den Hartog, D.J., *See* Sprott, J.C., 15:50115
Denby, B., Neural networks for triggering, 15:49269 (J;US)
Denning, R.S., Radionuclide release calculations for selected severe accident scenarios: Supplemental calculations, 15:48663 (R;US)
DePaolo, D.J., *See* Cole, D.R., 15:49739
Dequidt, E., The Spanish national program on the reliability of reactor pressure components: Summary report, 15:48569 (RA;XA)
Derenzo, S.E., *See* Haber, S.F., 15:49360
See Moses, W.W., 15:49321
Derevshchikov, A.A., Minidrift chambers. Operation with different gas mixtures, 15:49296 (R;SU;In Russian)
Dermer, C.D., Thermal Comptonization models for gamma-ray emission from black-hole sources: Volume 571, 15:49846 (BA;US)
DeShazer, M., Chemical weapons proliferation in the Middle East: What is the proper response. Study project, 15:48849 (R;US)
Deshmukh, P.C., *See* Lindle, D.W., 15:49132
Desmond, E., *See* Murphy, J.B., 15:49275
Desroches, P., Bottom ice, in situ and long term evaluation: Proceedings, 15:48447 (RA;CA)
Detraz, C., *See* Bazin, D., 15:50003
Deutscher, G., *See* Kresin, V.Z., 15:49122
Devenski, P.A., *See* Gramenitskij, I.M., 15:49306
Devgun, J.S., Environmental impact assessment for a radioactive waste facility: A case study, 15:48259 (R;US)
Waste management aspects of the Formerly Utilized Sites Remedial Action Program, 15:48258 (R;US)
Devoe, N.N., Differential seeding and regeneration in openings and beneath closed canopy in sub-tropical wet forest, 15:49568 (R;US)
Dewit, L., Clinical possibilities of neutron capture therapy, 15:49689 (RA;FR)
deWit, R., *See* Naus, D.J., 15:48608
DeWitt, J., *See* Ziock, H.J., 15:49374
Dexter, N., *See* Sprott, J.C., 15:50115
Dhami, P.S., *See* Ramanujam, A., 15:48223
Dhumwad, R.K., *See* Kartha, P.K.S., 15:48222
See Ramanujam, A., 15:48223
di Bartolo, R., *See* Halstead, R., 15:49173
Diamond, P.H., *See* Ritz, C.P., 15:50112
Dias, J.F., Manual for target thickness measurement by alpha particle irradiation, 15:50055 (R;BR;In Portuguese)
Digby, W.M., Detector, shielding and geometric design factors for a high-resolution PET system, 15:49347 (J;US)
See Hoffman, E.J., 15:49701
DiGiacomo, N., *See* Womersley, J., 15:49293
Dilmanian, F.A., A high-resolution SPECT system based on a microchannel-plate imager, 15:49346 (J;US)
Dimitrelis, D., *See* Topliss, R.J., 15:49068
DiNardo, R., *See* Majkrzak, C.F., 15:48857
Ding, J., *See* Gidaspow, D., 15:48111
Dimire, T., *See* Kennedy, C., 15:49329
Dittner, P.F., [Cross sections for lepton pair production and for capture of the pair-produced electrons to bound states of the fully-stripped projectiles]: Foreign trip report, July 18, 1990–August 31, 1990, 15:49917 (R;US)
Dixon, L.D., *See* Best, R.E., 15:48237
Dobryakov, A.V., Equilibrium of plasma filament with inhomogeneous field along on axis and without of longitudinal current, 15:50129 (R;SU;In Russian)
Dobson, D.C., *See* Blanchard, M.B., 15:48359
Doctor, R.D., Open-gradient magnetic separation for physical coal cleaning: Results for Pittsburgh No. 8 and Upper Freeport coals, 15:48071 (R;US)
Dodds, H.L., *See* Ibn-Khayat, M., 15:48671
Dodson, B.W., Stress accommodation in large-mismatch systems, 15:48979 (R;US)
Dolenc, D.A., Physical Sciences Program Area 1990 contract status report, 15:48178 (R;US)
Dolidze, M.G., Polarization phenomena in reactions of deuteron stripping type, 15:50038 (R;SU)
Dolinov, V.K., *See* Balashov, V.V., 15:50196
See Korenman, G.Ya., 15:50190

Dolphin, A.S., Effects of cathodic protection potential and stress ratio on fatigue thresholds of structured steels in sea water, 15:48894 (R;GB)
Domian, H.A., *See* Russell, E.W., 15:48369
Dominguez, N., *See* Harris, J.H., 15:50132
Donahoe, C., *See* Lobner, P., 15:48539
Donnelly, K.E, A data acquisition system for residential magnetic field source characterization, 15:48453 (R;CA)
Donskov, S.V., Specialized processor for particle momentum selection in the experiment to study of central hadron collisions, 15:49298 (R;SU;In Russian)
Dore, M.A., Effects of ionizing radiation on the performance of selected tactical combat crews. Technical report, 12 March 1986-30 October 1987, 15:49708 (R;US)
Dorri, N., *See* Iwanczyk, J.S., 15:49325
Dorris, S.E., $YBa_2Cu_3O_x$ superconductor coil: Processing and properties, 15:48914 (R;US)
Double, J.M., *See* Bridgwater, A.V., 15:48426
Doucet, H.J., Supersonic jets of cylindrical metallic plasma shells as imploding loads in high-power dense Z-pinch, 15:50111 (R;FR)
Douss, N., Dynamic study of solid adsorption heat pumps: Experiments and numerical simulation economic analysis for development: Final report, 15:48781 (R;LU)
Downing, R.W., *See* Nelson, R.O., 15:50245
Doxtader, M.M., *See* Jankowiak, R., 15:49646
Doyle, G., Future coal use in the Asia/Pacific region, 15:49427 (RA;US)
See Chung, F., 15:49431
Doyon, R., The strengths of the 2.3 μm CO band in luminous interacting and merging galaxies: Proceedings of the 22. Eslab Symposium, 15:49798 (RA;FR)
Drabkin, M., Waste-minimization opportunity assessment, Fort Riley, Kansas. Summary report, April 1989-December 1989, 15:49613 (R;US)
Dracos, M., Experimental study of the single electron response of the DELPHI Barrel RICH MWPC's, 15:49287 (R;FR)
Dragunov, Yu.G., Principal trends of investigation on substantiation of WWER vessel material serviceability: Summary report, 15:48568 (RA;XA)
Draine, B.T., Interstellar extinction in the infrared: Proceedings of the 22. Eslab Symposium, 15:49760 (RA;FR)
Dreux, P., *See* Platchkov, S., 15:49904
Drewery, J., *See* Fujieda, I., 15:49324
Drewery, J.S., *See* Cho, G., 15:49356
Drigert, M.W., *See* Khoo, T.L., 15:50011
Droege, M.W., *See* Wong, J., 15:48090
Droppo, J.G. Jr., Multimedia Environmental Pollutant Assessment System (MEPAS) application guidance: Volume 1, User's guide, 15:49548 (R;US)
Multimedia Environmental Pollutant Assessment System (MEPAS) application guidance: Volume 2, Guidelines for evaluating MEPAS input parameters, 15:49583 (R;US)
Supplemental mathematical formulations: The Multimedia Environmental Pollutant Assessment System (MEPAS), 15:49547 (R;US)
Drost, M.K., Results from a workshop on research needs for modeling aquifer thermal energy storage systems, 15:48690 (R;US)
Thermal energy storage for integrated gasification combined-cycle power plants, 15:48496 (R;US)
Droulillard, T.F., Anecdotal history of acoustic emission from wood, 15:50104 (R;US)
Drucker, H., Opening remarks on behalf of Argonne National Laboratory, 15:49419 (RA;US)
Drukier, A.K., Computer-oriented, multichannel, direct-current, superconducting quantum interference device. Final report, 30 September 1988-31 March 1989, 15:49201 (R;US)
Drzymala, J., Measurement and control of coal hydrophobicity, 15:48088 (R;US)
Duarte Neto, J., Comparison between the tricaprylylamine and trilaurilamine extrability in uranium and molybdenum extraction of low concentration liquors, 15:48212 (R;BR;In Portuguese)
Dubau, J., *See* Jacquemot, S., 15:50110
Dubosccq, J., *See* Cavalli-Sforza, M., 15:49359
Duclos, J., *See* Platchkov, S., 15:49904
Duda, S.W., *See* McNelis, D.N., 15:49723
Dudley, V., *See* Adkins, D.R., 15:48470
Dudley, W.W. Jr., Multidisciplinary hydrologic investigations at Yucca Mountain, Nevada: Volume 1, 15:48300 (BA;US)
Dufour, J.P., *See* Bazin, D., 15:50003
See Gaimard, J.J., 15:50006
See Hubert, F., 15:50002
Duggan, G.J., *See* Chacey, K.A., 15:48351
Dujsebaev, A.D., *See* Burtebaev, N.T., 15:49989
Dukhanov, V.I., *See* Mazurov, I.B., 15:49294
Dunham, S.E., *See* Capone, D.G., 15:49639
Dunlap, J.L., *See* Harris, J.H., 15:50132
Dunn, F.E., Thermal-hydraulic impact of failure of highly irradiated fuel pins on LMR passive safety, 15:48641 (R;US)
Dunne, W., *See* Killen, L., 15:48411
Duong, H.T., *See* Le Blanc, F., 15:50073
Duque, R.E., *See* Salzman, G.C., 15:49651
Dusek, J.T., *See* Dorris, S.E., 15:48914
Dutt, D.S., *See* Wright, A.E., 15:48640
Dutuit, O., *See* Verstraete, L., 15:49774
Dvoracek, J., A method for determination of the electron temperature from Langmuir probe data in a tokamak edge plasma, 15:50149 (RA;CS)
Dvornikova, N.A., Electron distribution function and rate constants of elementary processes in a tokamak near-wall plasma, 15:50128 (R;SU;In Russian)
Dworkin, A.S., *See* Zingg, S.P., 15:49144
Dwyer, J.P., *See* Halbleib, L.L., 15:48977
Dyatlov, V.G., *See* Volkov, Ya.F., 15:50158
Dyer, C.S., *See* Haskins, P.S., 15:49362
Dyer, G.R., *See* Harris, J.H., 15:50132
Dzhikia, G.V., Excited quark production at ep and γp colliders, 15:49933 (R;SU)
Dzhikiya, G.V., *See* Gershtejn, S.S., 15:49911

E

Easterling, J.B., Social issues and challenges in the disposal of nuclear waste: Volume 1, 15:48363 (BA;US)
Eaton, G.H., *See* Belushkin, A.V., 15:50079
Eaton, R.R., Computed distributions of residual shaft drilling and drift construction water in the exploratory facilities at Yucca Mountain, Nevada: Volume 1, 15:48349 (BA;US)
Eberhardt, L.E., *See* McCorquodale, S.M, 15:49640
Ebert, W.L., *See* Bates, J.K., 15:48981
Eby, E., *See* Kinch, R., 15:49502, 15:49512, 15:49606
See Rosengrant, L., 15:49477, 15:49478, 15:49479, 15:49480, 15:49484, 15:49499
Echer, C.J., *See* Blake, D.F., 15:48960
Eckels, P.W., *See* Wu, J.L., 15:49205
Edberg, T.K., *See* Parsons, A., 15:49345
Eddy, B.T., The preparation of synthetic fusion standards for use in the x-ray-fluorescence analysis of rocks and minerals, 15:49024 (R;ZA)
Edelson, M.C., Modern chemical analysis of nuclear materials, 15:48995 (R;US)
Edelstein, N., Analysis of the $5f^1 \rightarrow 6d^1$ transitions in PaX_6^{2-} (X = Cl, Br) and $Pa^{4+}/ThBr_4$, 15:49019 (RA;US)
See Anderson, D.M., 15:49063
See Williams, G.M., 15:49022, 15:49023
Edelstein, N.M., Actinide chemistry, 15:49004 (RA;US)
See Amberger, H.D., 15:49064
See Poirot, I.S., 15:49020
Edenburn, M.W., Reference concepts for a space-based hydrogen-oxygen combustion, turboalternator, burst power system, 15:49406 (R;US)
Edmonds, C.G., *See* Smith, R.D., 15:49025
Edmonds, J., Atmospheric trends and emissions of greenhouse gases, 15:49420 (RA;US)
Report of working group D: Priorities for research in risk management, 15:49424 (RA;US)
Edson, R.T., *See* Wilson, D.L., 15:49851
Edyvean, S., *See* Perry, B.J., 15:49682

Egbert, G.D., New approaches to estimation of magnetotelluric parameters: Annual report, 1 August 1989–31 July 1990, 15:49732 (R;US)
Eggert, K.G., *See* Birdsell, K.H., 15:48308
Egorov, O.K., Photoemulsion vertex detector at the SKIF installation, 15:49304 (R;SU;In Russian)
Ehfros, V.D., Resonating-group method in calculations of low-energy reactions and n^4He scattering with realistic NN interactions, 15:50026 (R;SU;In Russian)
Ehgartner, B.L., *See* Bauer, S.J., 15:48297
Ehrenfreund, P., *See* Leger, A., 15:49766
Eichelberger, J.C., *See* Carrigan, C.R., 15:49743
Eichhorn, B.W., *See* Kerby, M.C., 15:49055
Elkelboom, D.H., *See* van den Berg, R., 15:48156
Elros, C., Ice grains in the dust disk of the bipolar nebula M 1-92: Proceedings of the 22. Eslab Symposium, 15:49782 (RA;FR)
Elsenberg, D.C., Electron exchange between potassium bis(t-butyl(8)annulene)ytterbate(II) and potassium bis(t-butyl(8)annulene)ytterbate(III), 15:49061 (RA;US)
El-Jaick, L.J., *See* Linhares, M.P., 15:50067
El-Nour, R.A., Offshore ice problems in the Arctic Sea: Proceedings, 15:49194 (RA;CA)
Elevant, T., *See* Anderson, D., 15:50113
Elliott, N.E., *See* Smith, D.C., 15:48938
Ellis, D.E., Bonding and interaction of molecules with surfaces, 15:49861 (RA;BR)
Ely, D.W., *See* Haskins, P.S., 15:49362
Ely, R., *See* Wong, M., 15:49270
Ely, R.P., *See* Haber, C., 15:49273
See Yarema, R.J., 15:49371
Emanuel, A., *See* Carlson, J.H., 15:48356
Emery, M.S., *See* Bryan, W.L., 15:49561
See Newport, D.F., 15:49222
Emes, J., *See* Shutt, T., 15:49344
Emont, D., Small hydro-electric power stations, 15:48446 (R;FR;In FR, EN)
Encrenaz, T., IR spectroscopy of planets and satellites; Venus, Mars, giant planets and titan: Proceedings of the 22. Eslab Symposium, 15:49751 (RA;FR)
Near infrared spectroscopy of Mars: study of the surface mineralogy: Proceedings of the 22. Eslab Symposium, 15:49756 (RA;FR)
Encrenaz, Th., Observations of CO on Mars in the infrared and millimetre range: Proceedings of the 22. Eslab Symposium, 15:49755 (RA;FR)
Endsley, R., An automated linearity test for direct voltage calibrators, 15:49386 (R;US)
Eng, P., *See* Salib, P., 15:48199
Engel, D.W., *See* Apted, M.J., 15:48315
Engl, D., *See* Chung, F., 15:49431
England, A.C., *See* Harris, J.H., 15:50132
England, S.L., A technical and economic evaluation of sulphur basepad recovery and reclamation: Volume 1, 15:49585 (RA;CA)
England, T.R., Fission-product chain yields and delayed neutrons: ANS 5.2 and ANS 5.8, 15:49994 (R;US)
English, C.A., *See* King, S.L., 15:48862
English, M., *See* Wong, R.K.W., 15:49455
Enomoto, Ryoji, Charm physics in B factory, 15:49309 (RA;JP;In Japanese)
Particle identification in B-physics, 15:49311 (RA;JP;In Japanese)
Erb, P., *See* Dehli, M., 15:48829
Ericson, M.N., *See* Bryan, W.L., 15:49561
See Newport, D.F., 15:49222
Erin, S.V., *See* Derevshchikov, A.A., 15:49296
Eritsyan, G.N., *See* Arutyunyan, V.V., 15:49243
Ermakov, V.A., *See* Bogdzel', A.A., 15:49305
Eryurek, E., Sensor validation for power plants using adaptive backpropagation neural network, 15:48616 (J;US)
Escaravage, C., *See* Wood, D.S., 15:48871
Esen, E.B., *See* Obot, N.T., 15:49179
Eslinger, P.W., *See* Altenhofen, M.K., 15:48320
Espenson, J.H., *See* Simunic, J.L., 15:49034
Espey, B.R., Hα emission lines in high redshift quasars: Proceedings of the 22. Eslab Symposium, 15:49799 (RA;FR)
Essington, M.E., Formation of calcium and magnesium molybdate complexes in dilute aqueous solutions and evaluation of powellite solubility in spent oil shale, 15:48202 (R;US)
Estenne, V., Pion electroproduction near threshold on protons: how reaching the axial form factor of nucleon. Preparatory study of the experiment and pion spectrometer realization, 15:49906 (R;FR;In French)
Esteve, T., *See* Gaudiot, G., 15:49242
Eto, Ryozo, *See* Yoshimoto, Yasuhiko, 15:49717
Etula, H.J., An information system for 20 kV electricity distribution networks integrated to telecontrol and automation, 15:50236 (R;FI;In Finnish)
Euler, J.A., *See* Damiano, B., 15:48527
Evans, J.H., *See* Bradley, E.C., 15:48579
Evans, J.W., Electrical and electrochemical behavior of particulate electrodes, 15:49107 (RA;US)
Fluid flow and mass transport in small cavities, 15:49108 (RA;US)
See Hill, J., 15:49588
Evans, K.E., Productivity of agronomic and native plants under various fertilizer and seed application rates on a simulated transport corridor, Fort Norman, Northwest Territories: Volume 1, 15:49635 (RA;CA)
Evans, M.H., *See* Brown, M.J., 15:49213
Evseev, I.I., *See* Boyarinov, S.V., 15:49988
Ewing, R.I., A sensitive multi-detector neutron counter used to monitor cold fusion experiments in an underground laboratory: Negative results and positive artifacts, 15:49357 (J;US)
Exarhos, G.J., Influence of electron withdrawing groups and molecular conformation on the nonlinear optical response of derivatized phosphazenes, 15:49085 (BA;US)
Ezsoel, G., Comparison of PMK-NVH experimental results in the event of 7.4% cold and hot leg breaks: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48548 (RA;XA)

F

Fabriol, R., *See* Lehmann, J., 15:48273
Fachin, M., *See* Swoboda, C., 15:49336
Fairbanks, R.G., *See* Bard, E., 15:49029
Fajn, V.Eh., Application range of the impulse approximation at calculation of ion transport in matter: 2. Solid state physics and mass transfer simulation, 15:50058 (RA;SU;In Russian)
Fajnberg, Ya.B., *See* Miroshnichenko, V.I., 15:50157
Fakhri, Y., *See* Massiera, M., 15:48451
Falci, F.P., An innovative cask for transporting defense high-level waste: Volume 1, 15:49171 (BA;US)
Faloona, I.C., *See* Kober, E.M., 15:49089
Fang, M.M., *See* Finnemore, D.K., 15:48921
See Schwartzkopf, L.A., 15:48918
Fang, Z., Dynamic processor self-scheduling for general parallel nested loops, 15:50247 (J;US)
Fanous, F., *See* Greimann, L., 15:48654
Fardo, M., *See* Turko, B.T., 15:49333
Fargo, L., *See* Kinch, R., 15:49501
See Rosengrant, L., 15:49475
Farmer, M.T., CORQUENCH: A model for gas sparging-enhanced melt-water, film boiling heat transfer, 15:48644 (R;US)
The MELTSPREAD-1 computer code for the analysis of transient spreading in containments, 15:48643 (R;US)
Faron, R., Conversion of ore concentrates and reprocessed uranyl nitrate into UF_6: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988, 15:48213 (RA;XA)
Farouq Ali, S.M., How to make money producing heavy oil?, 15:48203 (RA;CA)
Farrell, J., *See* Christensen, M., 15:50244
Farrington, J.W., *See* Palmieri, J., 15:49610
Faulkner, K., The Northern Regional Programme for the acceptance testing of X-ray equipment: Tolerances, limiting values and appropriate measuring methods, 15:49663 (RA;GB)
Faulkner, M.G., User-friendly data entry routine for the ESP model. Final report, June 1988-September 1989, 15:49545 (R;US)
Fauvet, P., *See* Broc, M., 15:48859

Faya, A.J.G., *See* Souza, A.L., 15:48561
Fayer, M.J., Predicted drainage at a semiarid site: Sensitivity to hydraulic property description and vapor flow, 15:48287 (R;US)
Fedders, P.A., *See* Norberg, R.E., 15:48463
Fedulov, M.V., Possibility of using first collision probability method for solution of the problem of photon transport, 15:50125 (R;SU;In Russian)
Fedyakin, N.N., *See* Krasnokutskij, R.N., 15:49300
Feinberg, B., *See* Claytor, N., 15:49916
Fenici, P., *See* Casini, G., 15:50173
Feo, J., *See* Cann, D., 15:50242
Ferg, *See* Ziock, H.J., 15:49374
Ferguson, J.F., *See* Ander, M.E., 15:50107
Fernandez, J.A., A description and status of the Yucca Mountain Project repository sealing program: Volume 1, 15:48323 (BA;US)
Fernow, R.C., *See* Batchelor, K., 15:49225
Ferrando, W.A., Fabrication of composite high temperature superconductor wires from $Ag/YBa_2Cu_3O_x$ power produced by $AgNO_3$ decomposition, 15:48901 (R;US)
Ferrazzara, S.F., *See* Kettler, D.J., 15:48486
Ferrell, T.L., The photon scanning tunneling microscope, 15:49377 (R;US)
Ferrett, T.A., *See* Lindle, D.W., 15:49132
See Medhurst, L.J., 15:49131
See Piancastelli, M.N., 15:49133
Ferrigan, P.M., *See* Levich, R.A., 15:48334
Ferris, K.F., *See* Risser, S.M., 15:48972
Feuga, B., Deep geology program in France, third research phase (1985-1986), 15:48477 (R;FR;In French)
Fidone, I., Diagnosis of superthermal electrons using cyclotron radiation, 15:50121 (R;FR)
Fields, R.J., *See* Naus, D.J., 15:48608
Fil, N.S., Safety of the advanced WWER-1000 in condition of failure of the emergency protection system: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48554 (RA;XA)
Filippov, D.V., Kinetic limitations on sausage compression of Z-pinches, 15:50122 (R;SU;In Russian)
Filippov, G.F., *See* Asherova, R.M., 15:50025
See Ostashko, V.V., 15:50034
Finch, C.B., *See* Poirot, I.S., 15:49020
Finch, S.M., Hanford Environmental Dose Reconstruction Project: Monthly report, August 1990, 15:49546 (R;US)
Findlay, J.G., *See* Knowlton, T.M., 15:48210, 15:48211
Finlayson-Pitts, B., *See* Mautz, W.J., 15:49720
Finley, R.E., *See* Luke, B.A., 15:48333
Finnemore, D.K., Thermodynamic critical field of $Y_1Ba_2Cu_3O_7$, 15:48921 (R;US)
See Miller, T.A., 15:48922
See Schwartzkopf, L.A., 15:48918
See Verhoeven, J.D., 15:48876
Fischer, A.S., *See* Batchelor, K., 15:49225
Fischer, J., A many particle-tracking detector with drift planes and segmentel cathode readout, 15:49267 (J;US)
See Debbe, R., 15:49323
Fish, R.H., *See* Baralt, E., 15:48082
Fisher, K., *See* Fitzgerald, M., 15:49675
Fitzgerald, M., A protocol for the commissioning and routine testing of mammographic X-ray systems: Tolerances, limiting values and appropriate measuring methods, 15:49675 (RA;GB)
Flagan, R.C., Particle formation in combustion, 15:49552 (RA;FI)
Flambaum, V.V., *See* Sushkov, O.P., 15:50077
Flament, T., *See* Broc, M., 15:48859
Fleming, D.M., *See* Brown, R.C., 15:49557
Fleselmann, B., *See* Arya, R.R., 15:48462
Fleury, A., *See* Bazin, D., 15:50003
See Gaimard, J.J., 15:50006
See Hubert, F., 15:50002
Florence, A.L., *See* Miller, S.A., 15:49396
Floros, P., *See* Ball, A.H., 15:49331
Flynn, C.J., *See* Olsen, K.B., 15:49638
Foehl, J., Research activities related to nuclear power plant ageing in the Federal Republic of Germany: Summary report, 15:48525 (RA;XA)
See Kussmaul, K., 15:48605
Foell, W., *See* Chung, F., 15:49431
Foley, J.E., Heat transfer in a two-bed fluidized combustor, 15:48114 (R;US)
See Brown, R.C., 15:48116
Folkema, M.P, Handbook for small-to-medium size fuelwood chipping operations, 15:48412 (R;CA)
Fomin, P.I., Bose-condensation in limited two-dimensional systems and the critical temperatures of superconducting ceramics, 15:48925 (R;UA;In Russian)
Fong, F., *See* Gage, D.A., 15:49650
Fonti, S., *See* Colangeli, L., 15:49754
Fonzi, F., Alten activities in the field of biomass exploitation for energetic uses, 15:48429 (RA;LU)
Foote, R.S., *See* Brown, G.M., 15:49647
Forbes, J.M., Thermosphere-ionosphere coupling: An experiment in interactive modeling, 15:49850 (R;US)
Forsey, C.D., A technical and economic comparison of the conversion of natural and oxide reactor reprocessed uranium: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988, 15:48243 (RA;XA)
Forster, R.A., MCNP capabilities for nuclear well logging calculations, 15:49376 (J;US)
Forveille, T., *See* Omont, A., 15:49788
Fowkes, F.M., Chemical characterization of the surface sites of coal: Technical progress report, April–June 1989, 15:48084 (R;US)
Chemical characterization of the surface sites of coal: Technical progress report, April–June 1990, 15:48085 (R;US)
Fowler, J., *See* Capone, D.G., 15:49639
Fox, J., *See* Boyd, G., 15:48097
Foy, J.J., *See* Giles, M.S., 15:48372
Frank, A.M., *See* Tao, W.C., 15:49395
Fredley, J.M., *See* Willis, H.L., 15:48749
Freed, A.D., Stress versus temperature dependent activation energies in creep, 15:48852 (R;US)
Freeman, J.R., *See* O'Brien, K.J., 15:49893
Frei, Z., Chiral interface at the finite temperature transition point of QCD, 15:50048 (R;US)
Freund, F., *See* Blake, D.F., 15:48960
Freund, R., *See* Kallinger, W., 15:49665
Freund, R.F., Superconcurrent processing: A dynamic approach to heterogeneous parallelism. Final report, 15:50210 (R;US)
Freund, R.S., *See* Dalgarno, A., 15:49868
Fridley, D., Future patterns of electricity generation in Asia: Competing fuels and competing objectives, 15:49428 (RA;US)
Fridlund, C.V.M., *See* Nordh, H.L., 15:49767
Friesel, M.A., *See* Barga, R.S., 15:50239
Frisk, U.O., *See* Nordh, H.L., 15:49767
Fritz, D.J., *See* Ball, A.H., 15:49331
Fritz, I.J., Electric-field dependent electroreflectance and photocurrent spectroscopy in InGaAs/InAlAs strained-layer superlattices, 15:48974 (R;US)
Fritz, P., *See* Wolf, M., 15:49598
Frois, B., *See* Platchkov, S., 15:49904
Frye, G.C., Acoustic wave chemical sensors based on monitoring both velocity and attenuation, 15:49387 (BA;US)
Fu, R.K., Assessment of modular IGCC plants based on entrained flow coal gasification supplemental studies, 15:48489 (R;US)
Fuerst, J.D., An investigation of thermally driven acoustical oscillations in helium systems, 15:49251 (R;US)
Operation of a 2-phase return dewar in a satellite refrigerator, 15:49252 (R;US)
Fuhr, B.J., A study of asphaltene flocculation in heavy oil and asphalt solutions: Final report, 15:48174 (R;CA)
Study of asphaltene flocculation in heavy oil and asphalt solutions, 15:48173 (R;CA)
Fujieda, I., Improved charge collection of the buried p-i-n- a-Si:H radiation, 15:49324 (J;US)
See Cho, G., 15:49356
Fujii, A.T., *See* Isotani, S., 15:50071
Fujita, Yuzo, *See* Omata, Kazuo, 15:50218
Fuketa, Toyoshi, *See* Nakamura, Takehiko, 15:48583
Fukuda, Tomokazu, *See* Komori, Fumio, 15:50072

Fukushima, Susumu, Design, construction and performance tests of atomic emission spectrograph with DCA and ICP excitation systems for plutonium bearing fuels, 15:48997 (R;JP;In Japanese)
Fukuyama, A., *See* Itoh, K., 15:50181
Fuller, E.R., *See* Krause, R.F., 15:48942
Fullerton, H.E., *See* Gregor, J.H., 15:48078
Funatsu, Y., *See* Kubono, S., 15:50004
Fung, M.Y.P., *See* Dai, T.S., 15:48208
Fursaev, D.V., *See* Kadyshevskij, V.G., 15:49972
Furtado, W.W., *See* Isotani, S., 15:50071

G

Gadea, A., *See* Michel, E., 15:48466
Gaertner, M., Irradiation testing of SIEMENS/KWU LWR fuel in the HFR Petten, 15:48531 (RA;FR)
Gage, D.A., Abscisic acid biosynthesis in isolated embryos of Zea mays L., 15:49650 (J;US)
Gagnon, P., *See* Cavalli-Sforza, M., 15:49359
Gaimard, J.J., Isotopical separation of relativistic projectile fragments, first experiments at SATURNE, 15:50006 (RA;FR)
Gajdica, R.J., A semianalytical thermal model for linear steamdrive, 15:48135 (BA;US)
Gajsak, I.I., *See* Akimov, Yu.K., 15:50010
Gainyda, J., *See* Murphy, J.B., 15:49275
Galeotti, *See* Haber, C., 15:49273
Galetti, M.R.S., Post-test analysis of SPE-2 with TRAC-PF1: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48550 (RA;XA)
Gallagher, J.R., *See* Mayer, G.G., 15:48092
Gallardo, J., *See* Batchelor, K., 15:49225
Galmiche, D., Evidence of Rayleigh-Taylor instabilities in tri-layer targets, 15:50166 (R;FR)
Galyean, W.J., *See* Kelly, D.L., 15:48670
Gamayunov, S.N., *See* Zaveryaev, V.S., 15:50144
Gambaccini, M., A phantom for quality control in mammography: Tolerances, limiting values and appropriate measuring methods, 15:49677 (RA;GB)
An electronic instrument for high-voltage measurements of an X-ray unit for mammography: Tolerances, limiting values and appropriate measuring methods, 15:49678 (RA;GB)
Gamboa, J., Functionals Hartree-Fock equations in the Schrodinger representation of quantum field theory, 15:50094 (R;BR)
Quantum mechanics of relativistic particles in multiply connected spaces and the Aharonov-Bohm effect, 15:50095 (R;BR)
Gandhi, S., *See* Krause, F., 15:48784
Gangloff, R.P., Corrosion fatigue crack propagation in metals, 15:48893 (R;US)
Garbey, M., Symbolic manipulation software and the study of differential equations, 15:50215 (R;US)
Garcia, C., *See* Prieto, M., 15:49804
Garcia, L., *See* Chung, F., 15:49431
Garcia, M.R., *See* Vrtilek, S.D., 15:49837
Garcia-Sucre, M., Real and complex scaling methods in atoms and molecules, 15:49860 (RA;BR;In Spanish)
Gardani, M., MITRA an advanced code to calculate radionuclide release from nuclear fuels under general irradiation conditions, 15:48619 (R;FR)
Gardner, J.E., National Educators' workshop: Update 1989 standard experiments in engineering materials science and technology, 15:48853 (R;US)
Gardner, W.E., *See* Darlaston, B.J., 15:48565
Garg, U., *See* Khoo, T.L., 15:50011
Garner, S.J., The application of flexible jet grout for a cutoff at John Hart Dam: Proceedings, 15:48452 (RA;CA)
Garrett, W.R., *See* Payne, M.G., 15:49871
Garvey, R.E., Potential for advanced thermoplastic composites in space systems, 15:49405 (R;US)
Gasc, B., *See* Rouviere, R., 15:48651
Gasilov, V.A., Gas jet magnetic compression dynamics, 15:50124 (R;SU;In Russian)
Gast, P., Siemens UB KWU-Code package for severe accidents: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48560 (RA;XA)
Gatford, C., *See* Midgley, D., 15:48545, 15:48993
Gaudiot, G., The main aspects of the Vivitron mechanical structure, 15:49242 (R;FR)
Gay, J., *See* Maillard, J.P., 15:49793
Gbric-Galic, D., *See* Brush, L.H., 15:48288
Geddes, W.D, Engineering manual for the design and installation of ground and water source heat pump systems: Volume 1, 15:48769 (R;CA)
Installer's manual for the design and installation of ground and water source heat pump systems: Volume 2, 15:48770 (R;CA)
Gee, G.W., *See* Fayer, M.J., 15:48287
Geesaman, D.F., Nucleon parton distributions and nuclear structure, 15:49979 (R;US)
Gehin, J.C., A nodal method for the solution of the static, few-group diffusion equations in hexagonal geometry, 15:48593 (R;US)
Geissel, H., *See* Gaimard, J.J., 15:50006
See Hubert, F., 15:50002
Geissler, G.O., Multiloop Integral System Test (MIST): Final report: MIST phase 4 tests: Volume 11, 15:48665 (R;US)
Multiloop Integral System Test (MIST): Final report: MIST Phase 4 tests, 15:48666 (R;US)
Gelbard, E.M., Computation of standard deviations in eigenvalue calculations, 15:50052 (R;US)
Gelbard, F., One-dimensional radionuclide transport under time-varying conditions: Volume 1, 15:48305 (BA;US)
Gelinas, P., *See* Locat, J., 15:49586
Geller, E.W., *See* Ho, C.M., 15:48805
Generazio, E.R., Theory and experimental technique for nondestructive evaluation of ceramic composites, 15:48967 (R;US)
Geng, G.Q., Behavior of tubing steels in FBC in-service testing, 15:48118 (RA;US)
Gens, R.F., *See* Constant, R.J., 15:48636
Genzel, R., Photodissociation regions: observations and theory: Proceedings of the 22. Eslab Symposium, 15:49763 (RA;FR)
George, A.C., An overview of instrumentation for measuring environmental radon and radon progeny, 15:49562 (J;US)
George, E.P., Mechanical properties, fracture behavior, and grain-boundary chemistry of B-doped NiAl, 15:48867 (R;US)
Georgekish, H., *See* Grande, N., 15:48448
Georgievskij, A.V., *See* Vorob'eva, V.P., 15:50179
Gerding, T.J., *See* Bates, J.K., 15:48981
Gerin, M., *See* Encrenaz, Th., 15:49755
Gerlach, T.M., *See* Cole, D.R., 15:49739
Germano, G., A study of data loss and mispositioning due to pileup in 2-D detectors in PET, 15:49700 (J;US)
Gershtejn, S.S., Perspectives of experimental study of electromagnetic form factors of unstable particles at UNK, 15:49911 (R;SU;In Russian)
Gerson, R., *See* Dilmanian, F.A., 15:49346
Gertsen, G.N., *See* Akopova, A.B., 15:49292
Gerusov, A.V., Maximum compression of Z-pinch in a gas with high atomic number, 15:50150 (R;SU;In Russian)
Gerzon, S.A., *See* Boyarinov, S.V., 15:49988
Geshkenbejn, B.V., Quantum chromodynamics with infinite number of vector mesons, 15:49941 (R;SU)
Gheri, F., The LEBEN project as an example of an integrated agro-energy approach, 15:48415 (RA;LU)
Giachetti, R.T., Contribution of Anticipated Transients Without Scram (ATWS) to core melt at United States nuclear power plants, 15:48647 (R;US)
Gibeaut, D.M., Synthesis of cell wall xylans and glucans by golgi membranes, 15:49649 (J;US)
Gibson, J.D., Synthesis of studies for the potential of fault rupture at the proposed surface facilities, Yucca Mountain, Nevada: Volume 1, 15:48309 (BA;US)
Gidaspow, D., Computer modeling of a CFB [circulating fluidized bed] gasifier: Third technical progress report, 15:48111 (R;US)
Gil'varg, A.B., *See* Gryzgunov, V.A., 15:50137
Gilbert, R.L., Proof of concept testing of the advanced NOXSO flue gas cleanup process: Quarterly technical progress report, April 1–June 30, 1990, 15:48512 (R;US)

Giles, M.S., Environmental survey at Lucas Heights Research Laboratories, 1987, 15:48372 (R;AU)
Gillemot, F., Reactor reliability research in Hungary in 1988: Summary report, 15:48563 (RA;XA)
Gillett, N.A., *See* Mauderly, J.L., 15:49721
Gillies, R., Effects of produced sand on short distance pipeline transportation of heavy oil in water emulsions: SRC [Saskatchewan Research Council] pipeloop test results: Final report, 15:48172 (R;CA)
Gilmore, F.R., *See* Laher, R.P., 15:49891
Gilroy, D.G., Testing of indoor radon-reduction techniques in 19 Maryland houses. Final report, January 1987-June 1989, 15:49531 (R;US)
Ginley, D.S., *See* Ewing, R.I., 15:49357
Ginot, P., *See* Manesse, D., 15:48639
Ginsburg, N., Opening remarks on behalf of the East-West center, 15:49418 (RA;US)
Giraud-Heraud, Y., *See* Shutt, T., 15:49344
Girdley, W.A., *See* Kalia, H.N., 15:48335
Giribet, C.G., *See* Contreras, R.H., 15:50066
Giruzzi, G., *See* Fidone, I., 15:50121
Glaccum, W., *See* Omont, A., 15:49788
Gladstone, G.R., *See* Chakrabarti, S., 15:49361
Glantz, M., *See* Edmonds, J., 15:49424
Glasov, O.N., *See* Lebedev, N.N., 15:48613
Glasse, A.C.H., Infrared spectroscopy in astronomy: Proceedings of the 22 Eslab Symposium, 15:49750 (R;FR)
Glazov, V.M., Study of constitution diagram aluminum-tantalum, 15:48856 (R;US)
Glish, G.L., Real-time vapor monitoring with MS/MS, 15:49558 (BA;US)
Glotov, A.I., *See* Bashmakov, V.S., 15:49228, 15:49249
Glowienka, J.C., *See* Harris, J.H., 15:50132
Glumac, B., Sensitivity analysis approach to P-T limits and pressurized thermal transient: Summary report, 15:48567 (RA;XA)
Glushko, N.I., Saturation of hadron process at high energies: alternative approaches to its realization, 15:49948 (R;UA)
Gnatyk, B.I., Formation and dynamics of shell structures in the astrophysical systems under the accretion of gas on the source of wind activity, 15:49813 (R;UA;In Russian)
Gnirk, P., *See* Alexander, D., 15:48355
Godin, M.S., *See* Lister, D.H., 15:48544
Goeltz, R., *See* Tonn, B.E., 15:48699
Goeringer, D.E., *See* Ramsey, J.M., 15:49872
Gokhale, A.J., *See* Burnet, G., 15:48094
Goldberg, M., *See* Woody, C.L., 15:48940
Goldey, P.R., *See* Ball, A.H., 15:49331
Goldstein, H.F., Nonlinear pressure dependence of T_c in single-crystal superconducting BiCaSrCuO, 15:48927 (RA;US)
Gollihar, K.G., A program to qualify ductile cast iron for use as a containment material for Type B transport cask, 15:49165 (R;US)
See Falci, F.P., 15:49171
Golovachik, V.T., On interpreting the results of personnel dosimeter intercomparison, 15:49301 (R;SU;In Russian)
Goloviznin, V.M., *See* Belikov, V.V., 15:50176
Golshan-Shirazi, S., *See* Czok, M., 15:49026
Golubev, V.I., *See* Blokhin, A.I., 15:50009
Golubinskij, P.K., Parametric instabilities of electromagnetic waves in layer of plasma-molecular medium, 15:50152 (R;UA;In Russian)
Gomes, J.S., *See* Contreras, R., 15:49032
Gomes, M., Gauge structure, anomalies and mass generation in a three dimensional thirring model, 15:49965 (R;BR)
Gomez del Campo, J., *See* Claytor, N., 15:49916
Gomez, J.J., *See* Rouse, F., 15:49272
Gomez-Cadenas, J.J., *See* Kent, J., 15:49322
See Von Zanthier, C., 15:49268
Gonchar, V.Yu., *See* Bolotin, Yu.L., 15:50102
Gonzalez Riestra, R., *See* Glasse, A.C.H., 15:49750
Gonzalez, H., *See* Swoboda, C., 15:49336
Gonzalez, R., *See* Chatelard, P., 15:48534
Goodarzi, F., *See* Bustin, R.M., 15:48126
Goodenough, J.B., *See* Lightfoot, P., 15:48913
Goodman, B.J., Assessment of municipal solid waste for energy production in the western United States, 15:48833 (R;US)
Goodman, C.D., *See* Taddeucci, T.N., 15:50000
Gopalakrishnan, V., *See* Ramanujam, A., 15:48223
Gorbics, M.S., ARTEMIS: A VMS based FASTBUS module testing and evaluation system, 15:49281 (J;US)
Gordon, A.Z., *See* Cook, W.J., 15:48503, 15:48504, 15:48505, 15:48506, 15:48507, 15:48508, 15:48509
Goretta, K.C., *See* Singh, J.P., 15:48916
Gorin, Yu.P., Processing of the information from gamma detector at SIGMA-AJAX setup, 15:49307 (R;SU;In Russian)
Gornushkin, Yu.A., *See* Gorin, Yu.P., 15:49307
Gorshkov, A.V., Thomson scattering equipment for investigation of plasma filament scrape-off layer at the T-10 tokamak, 15:50126 (R;SU;In Russian)
Gosling, F.G., The Manhattan Project: Science in the Second World War, 15:49397 (R;US)
Gostkin, M.I., *See* Akimov, Yu.K., 15:50010
Goudonnet, J.P., *See* Ferrell, T.L., 15:49377
Gouffon, A., Safety problems related to the use of MOX assemblies in PWRS, 15:48543 (R;FR)
Gould, H., High-energy atomic physics, 15:49887 (RA;US)
See Claytor, N., 15:49916
Goulding, F.S., Large coaxial germanium detectors, 15:49339 (J;US)
See Madden, N.W., 15:49330
Goulo, V.G., "ACTV-F/H" Neutron activation cross-section library for fusion reactor design: Data from the Hanford REAC*2 Data Library, 15:49986 (R;XA)
Goutte, D., *See* Platchkov, S., 15:49904
Grabke, H.J., *See* Pflugfelder, G., 15:48874
Grabosch, H.J., *See* Brunner, J., 15:49928
Grabowski, Z.W., *See* Khoo, T.L., 15:50011
Grady, S.T., Development of transportation operations requirements: Operations planning: Volume 1, 15:48238 (BA;US)
Graettinger, T.M., *See* Krauss, A.R., 15:48911
Graham, S., *See* Tingle, T.N., 15:48179
Gramenitskij, I.M., About a possibility to study the diffraction dissociation on the vertex detector spectrometer, 15:49306 (R;SU;In Russian)
Grande, N., Operation of an isolated mini-hydro plant in northern Quebec: Proceedings, 15:48448 (RA;CA)
Grange, P., *See* Churin, E., 15:48425
Granryd, E., Thermal performance analysis for heat exchangers using nonazeotropic refrigerant mixtures, 15:48772 (R;US)
Grassi, G., Bio-energy-industrial integrated regional projects in the European community, 15:48409 (RA;LU)
The pyrolysis technology a perspective for the future, 15:48414 (RA;LU)
Gray, A.J., *See* Williams, J.M., 15:49096
Gray, J., *See* Yorkey, T., 15:49652
Gray, W.J., *See* Wilson, C.N., 15:48220
Graziani, G., *See* Raes, F., 15:48648
Grdlichka, E.S., Light quark mass relations from finite energy sum rules, 15:49947 (R;UA)
Green, H.J., *See* Bharathan, D., 15:48471
Green, J.C., *See* Anderson, D.M., 15:49063
Green, S., *See* Christensen, M., 15:50244
Greenberg, M., *See* Schmitt, B., 15:49772
Greene, S.V., *See* Debbe, R., 15:49323
See Fischer, J., 15:49267
Greenwood, L.R., *See* Smith, D.L., 15:49980
Gregoire, C., Level density parameter of nuclei at finite temperature, 15:50008 (R;FR)
Gregor, J.H., Upgrading Fischer-Tropsch naphtha, 15:48078 (R;US)
Gregoric, M., Emergency operating procedures for SGTR sequence: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48552 (RA;XA)
See Petelin, S., 15:48549
Greimann, L., Effects of design details on the capacity of steel containment buildings, 15:48654 (R;US)
Grejda, A., *See* Clem, W.L., 15:48324
Grenier, P., *See* Douss, N., 15:48781
Grezo, C.A.B., *See* Coughtrey, P.J., 15:49711
Griffin, J.W., *See* Olsen, K.B., 15:49638
Grigor'ev, S.F., *See* Gasilov, V.A., 15:50124
Grigoryan, N.E., *See* Arutyunyan, V.V., 15:49243

Grigoryan, N.K., *See* Arakelyan, E.A., 15:49289
Grim, R., Infrared diagnostics for interstellar solid state chemistry: Proceedings of the 22. Eslab Symposium, 15:49764 (RA;FR)
See Schmitt, B., 15:49772
Grindrod, P., *See* Shaw, W., 15:48280
Grisham, A.E., Intelligence support to arms control. Study project, 15:48850 (R;US)
Grishchenko, V.F., *See* Bukharbaev, K.S., 15:50082
Gronsky, R., *See* Burmester, C.P., 15:48932
Grossenbacher, K., *See* Karasaki, K., 15:48339
Grossi, L., *See* Raes, F., 15:48648
Gruen, D.M., The transuranium elements: Members of the 5f series, 15:49869 (R;US)
See Krauss, A.R., 15:48911
Grundmann, U., *See* Hadek, J., 15:48599
Gryzgunov, V.A., High-resolution spectrometer with a spherical crystal for the T-15 tokamak, 15:50137 (RA;CS;In Russian)
Gschneidner, K.A. Jr., *See* Nakahara, J.F., 15:48956
Guang, Xia, *See* Chiang, Shan-Hsin, 15:49436
Guentert, F., *See* Pflugfelder, G., 15:48874
Guer, T.M., *See* Burmester, C.P., 15:48932
Guerrero, T.M., Characterization of a whole body imaging technique for PET, 15:49699 (J;US)
Guha, S., Research on high-efficiency, multiple-gap, multi-junction amorphous silicon-based alloy thin-film solar cells: Final subcontract report, March 1, 1987–February 28, 1990, 15:48464 (R;US)
Guisdeur, R., *See* Rouviere, R., 15:48651
Guiseu, S., *See* Collinet, J., 15:48540
Guiheux, J.M., *See* Presta, M., 15:48247
Guilliemaud-Mueller, D., Investigation of the particle stability of the isotope ^{26}O in the nuclear reactions 44 MeV/A ^{48}Ca+Ta: Collection, 15:50005 (RA;SU)
See Bazin, D., 15:50003
Guilleminot, J.J., *See* Douss, N., 15:48781
Guiochon, G., *See* Czok, M., 15:49026
Guia, A., Kinetics of the excited mesic hydrogen in the mixture of hydrogen isotopes, 15:50191 (RA;GB)
Gullichsen, J., Utilization of resources of the wood pulping industry - a holistic view: Volume 1, 15:48826 (RA;FI)
Gulmez, E., *See* Taddeucci, T.N., 15:50000
Gulyaev, V.A., Diagnostic system CAE T-15 and prospects of its development, 15:50136 (RA;CS;In Russian)
Gunter, D.L., Three-dimensional imaging utilizing energy discrimination, 15:49703 (J;US)
Guo, J., *See* Chang, H.L.M., 15:48915
Gurchenok, G.S., *See* Bukharbaev, K.S., 15:50082
Gurgel, J., *See* Douss, N., 15:48781
Gusejnov, A.G., *See* Badikov, S.A., 15:49999
Guseva, E.V., Low-energy conversion electrons from primary fragments of uranium 235 fission by thermal neutrons, 15:50016 (R;SU;In Russian)
Guss, P.P., *See* Kraiman, J.B., 15:50189
Gussenhoven, M.S., Simultaneous relativistic-electron and auroral-particle access to the polar caps during interplanetary magnetic field Bz northward: A scenario for an open-field line source of auroral particles, 15:49852 (R;US)
Gustafson, P., Report of working group A: Priorities for research in sea-level rise, 15:49440 (RA;US)
Gustavson, D.B., The scalable coherent interface, IEEE P1596: Status and possible applications to data acquisition and physics, 15:49334 (J;US)
Gusynin, V.P., Bound states and the formalism of composite operators in gauge theories, 15:49967 (R;UA;In Russian)
Seeley-Gilkey coefficients for the fourth-order operators on a Riemannian manifold, 15:49969 (R;UA)
Gvozdetskij, V.S., The spectra of spontaneous emission from inhomogeneous plasma half-space, 15:50151 (R;UA;In Russian)
Gwo, D.H., *See* Robinson, R.L., 15:48999

H

Haas, E.W., *See* Beyer, H., 15:48289
Haas, J.W. III, Surface-enhanced Raman spectroscopic (SERS) measurements in the liquid phase, 15:49027 (BA;US)
Haas, O., *See* Blaser, J.P., 15:50197
Haber, C., Design and prototyping of the front end readout system for the CDF silicon vertex detector, 15:49273 (J;US)
See Kirsten, F.A., 15:49332
See Wong, M., 15:49270
See Yarema, R.J., 15:49371
Haber, S.F., Application of mathematical removal of positron range blurring in positron emission tomography, 15:49360 (J;US)
Hachemi, H., *See* Platchkov, S., 15:49904
Hada, Kazuhiko, *See* Hirano, Masashi, 15:48575
Hadek, J., Rod drop in the LR-0 reactor core comprising 55 fuel assemblies: A comparison of theoretical and experimental data, 15:48599 (R;CS;In Russian)
Haemaeleainen, P., *See* Etula, H.J., 15:50236
Haenninen, H., *See* Toerronen, K., 15:48521
Haggag, F.M., [High-temperature reactor materials for gas-cooled reactor]: Foreign trip report, August 24, 1990–September 1, 1990, 15:48578 (R;US)
Hagiwara, R., A lithium/C_2F primary battery, 15:49098 (RA;US)
The preparation of planar-sheet graphite fluorides C_xF with $X < 2$, 15:48964 (RA;US)
Hajek, B.K., *See* Bhatnagar, R., 15:48614
Hake, K., *See* Tonn, B.E., 15:48699
Halama, H., *See* Murphy, J.B., 15:49275
Halbleib, L.L., Implementation of a QML (Qualified Manufacturer's List) methodology for discrete semiconductors, 15:48977 (R;US)
Haldeman, M., *See* Swoboda, C., 15:49336
Hale, H.J., Preliminary conceptual design description of the proposed DOE store-only monitored retrievable storage (MRS) facility: Volume 1, 15:48357 (BA;US)
Hall, C.A., *See* Hawke, R.S., 15:49167
Haller, E.E., Semiconductor materials and devices, 15:49073 (RA;US)
See Navarro, H., 15:48966
See Park, I.S., 15:49074
See Shutt, T., 15:49344
Halstead, R., State of Nevada nuclear waste shipping cask design studies: Volume 1, 15:49173 (BA;US)
Halverson, M., *See* Connor, C., 15:48795
Hamblin, D.M., Commercial sector gas cooling technology frontier and market share analysis, 15:48771 (R;US)
Hamelin, B., *See* Bard, E., 15:49029
Hamley, P.T., A handbook for management of oil and gas activities on lands in Alaska: Petroleum industry practices, environmental impacts and stipulations, 15:48149 (R;US)
Hammer, H., The pyrolysis for biomass is available in industry-scale and ready for the production of energy, 15:48418 (RA;LU)
Hammond, B.L., Damped-core quantum Monte Carlo: An effective treatment for large-z systems, 15:50233 (RA;US)
See Braga, M., 15:49046
Hamnen, H., *See* Anderson, D., 15:50113
Han, C.C., *See* Xia, W., 15:48951
Hanami, H., Numerical study of compressible magnetoconvection with an open transitional boundary, 15:49748 (R;US)
Hanatani, K., *See* Itoh, K., 15:50181
Hance, R., *See* Swoboda, C., 15:49336
Handa, Muneo, *See* Fukushima, Susumu, 15:48997
Handy, B, Measurement of biogenic and anthropogenic volatile organic compounds during the Canadian Atmospheric Study, July 17 to August 31, 1988, 15:49472 (R;CA)
Handy, B., Measurement of biogenic and anthropogenic volatile organic compounds during the Canadian atmospheric chemistry study, July 17 to August 31, 1988, 15:49466 (R;CA)
Hane, J.K., *See* Harris, C.B., 15:48961
Hanelt, E., *See* Gaimard, J.J., 15:50006
See Hubert, F., 15:50002
Hannane, F., Modelization and PC-based control of a distillation column - heat pump system, 15:48811 (R;FR;In French)
Hansen, M.C., Performance evaluation of a groundwater and soil gas remedial action, 15:49566 (R;US)
Hansen, N.R., Tethered rocket as a vehicle for penetration and impact testing: Development report, 15:49393 (R;US)

Hansen, O., Proceedings of the workshop on heavy ion physics at the Alternating Gradient Synchrotron (AGS), 15:49978 (R;US)
Hansen, R.A., Stability of RMS Lg measurements and their potential for accurate estimation of the yields of Soviet underground nuclear explosions. Technical report, November 1989-31 January 1990, 15:49402 (R;NO)
Hanson, D., *See* Boyd, G., 15:48097
Hanson, G.P., Quality assurance and the World Health Organization initiative of 'Health for All': Tolerances, limiting values and appropriate measuring methods, 15:49666 (RA;GB)
Hanson, P.J., *See* Norby, R.J., 15:49726
Hanssen, J.E., Foams for effective gas blockage in the presence of crude oil, 15:48134 (BA;US)
Hara, S., *See* Ishihara, T., 15:50193
Harar, S., Central collisions at the fermi energy, 15:50012 (R;FR)
Harding, J.H., Thermophysical and thermochemical properties of fast reactor materials, 15:48872 (R;FR)
Hardy, J.E., Measurement of two-phase flow momentum with force transducers, 15:48645 (R;US)
See Carnal, C.L., 15:48226
Hardy, M.P., *See* Bauer, S.J., 15:48297
Harkness, J.B.L., *See* Medelsohn, M.H., 15:48499
Harmon, J.E., Nuclear Technology Programs semiannual progress report, October 1987–March 1988, 15:48729 (R;US)
Harmon, K., *See* Banks, W.W., 15:49731
Harries, W.L., *See* Kern, K.T., 15:48968
Harrigan, R.W., The role of model based control in robotics, 15:50248 (J;US)
Harris, A.I., *See* Genzel, R., 15:49763
Harris, C.B., A new method for surface structure using a combination of second harmonic generation and coverage-dependence fluorescence, 15:49035 (RA;US)
Energy transfer and structural studies of molecules on surfaces, 15:49125 (RA;US)
Fundamental studies of bond breaking and forming on ultrafast timescales, 15:49036 (RA;US)
Picosecond studies of the electron-hole pair dynamics in CdS_xSe_{1-x} graded semiconductors, 15:48961 (RA;US)
Studies of chemical reactivity in condensed phase, 15:49037 (RA;US)
Harris, J., *See* Ritz, C.P., 15:50112
Harris, J.H., Fluctuations and stability in the Advanced Toroidal Facility (ATF) torsatron, 15:50132 (R;US)
Harris, M.C., *See* Kack, G.J., 15:48498
Harris, P.A., Initiating event identification and screening for nuclear waste repository preclosure risk assessment: Volume 1, 15:48378 (BA;US)
Harris, S.J., Short-fibre and particulate-reinforced metal-matrix composites, 15:48907 (R;US)
Harris, T., *See* Edmonds, J., 15:49424
Harrison, C.D., *See* Arnold, B.J., 15:48104
Harrison, G.S., *See* Hamley, P.T., 15:48149
Harrison, L.J., *See* Wright, A.E., 15:48640
Harrison, R.M., *See* Faulkner, K., 15:49663
Hart, R.C., *See* Payne, M.G., 15:49871
Hartmann, D., Distance limits for gamma-ray bursts from galactic neutron stars: Volume 571, 15:49843 (BA;US)
Hartnett, S.L., *See* Hansen, M.C., 15:49566
Harvey, A.H., Explicit approximations to the mean spherical approximation (MSA) for electrolyte systems with unequal ion sizes, 15:50232 (RA;US)
Harvey, J.A., Cosmological baryon and lepton number in the presence of electroweak fermion-number violation, 15:49820 (R;US)
Harvey, P.M., *See* Omont, A., 15:49788
Harvey, S.M, Exposure system for animal studies involving high-level 60-Hz magnetic fields, 15:49729 (R;CA)
Hashem Pesaran, M., An econometric analysis of exploration and extraction of oil on the U.K. continental shelf, 15:48142 (R;GB)
Hashimoto, Osamu, *See* Komori, Fumio, 15:50072
Hashimoto, Yukio, *See* Sakata, Fumihiko, 15:50031
Hasinger, G., *See* Vrtilek, S.D., 15:49837
Haskins, P.S., The shuttle activation monitor: A system for direct comparison of gamma-ray detector materials in a space environment, 15:49362 (J;US)
Hatori, Tadatsugu, *See* Urata, Kazuhiro, 15:50163
Haumann, J.R., *See* Crawford, R.K., 15:49320
Hauser, A.K., The effect of Schmidt number on the Faradaic impedance, 15:49120 (RA;US)
Havenith, M., *See* Cohen, R.C., 15:49047, 15:49139
Havukainen, R., Quality control of dental X-ray units: Tolerances, limiting values and appropriate measuring methods, 15:49679 (RA;GB)
Hawarden, T., *See* Puxley, P., 15:49805
Hawke, R.S., Railgun performance with a two-stage light-gas gun injector: Revision 1, 15:49167 (R;US)
Hawkins, R.A., *See* Guerrero, T.M., 15:49699
Haws, D., *See* Copeland, E.J., 15:49823
Hay, B.P., Molecular mechanics study of the structure of lanthanide complexes, 15:49091 (BA;US)
See Smith, P.H., 15:49090
Hayashi, T., *See* Leung, K.T., 15:48962
Hayes, R.D., Biomass pyrolysis technology and products. A Canadian viewpoint, 15:48420 (RA;LU)
Haymaker, R.W., Color flux distribution in pure SU(2) Lattice Gauge Theory, 15:49924 (R;US)
Haymes, G.T., Atikokan TGS aquatic studies, 1981 to 1988, II: Water chemistry, 15:48516 (R;CA)
HcHargue, C.J., The chemical state of iron ions implanted into silicon carbide, 15:48950 (R;US)
HcHugh, S., *See* Cavalli-Sforza, M., 15:49359
Hearst, J.R., Environmental corrections for a neutron-induced gamma-ray spectroscopy logging system in an air-filled borehole, 15:49401 (J;US)
Heath, W.A., *See* Hawke, R.S., 15:49167
Hebble, T.L., *See* Barkman, W.E., 15:49169
Heben, M.J., Efficient photovoltaic devices for InP semiconductor/liquid junctions. Technical report, 15:48454 (R;US)
See Miskelly, G.M., 15:50108
Heckendorn, F.M., *See* Ward, C.R., 15:49175
Hedgpeth, J.W., Willapa Bay: A historical perspective and a rationale for research, 15:49593 (R;US)
Hedman, B., *See* Iwanczyk, J.S., 15:49325
Heelis, R.A., Electrodynamics of the high-latitude ionosphere. Final report, September 1986-September 1989, 15:49858 (R;US)
Heeney, D., *See* Sanger, T., 15:49470
Heeren, L.L., *See* Constant, R.J., 15:48636
Heese, R., *See* Murphy, J.B., 15:49275
Heiken, G., Discussion paper on environmental hazards on the Moon, in low Earth orbit, and in low Mars orbit, 15:49817 (R;US)
Heimann, P.A., *See* Lindle, D.W., 15:49132
See Medhurst, L.J., 15:49131
See Piancastelli, M.N., 15:49133
Hejna, J., Experimental research of local hydrodynamic characteristics of fast reactor fuel assembly peripheral zone. 5: Results of measurement at group displacement. SPOGVY variants, 15:48584 (R;CS;In Russian)
Experimental research of local hydrodynamic characteristics of fast reactor fuel assembly peripheral zone. 6: Turbulent flow microstructure at a group displacement of the rods, 15:48585 (R;CS;In Russian)
Experimental research of local hydrodynamic characteristics of fast reactor fuel assembly peripheral zone. 7: Results of measurement in entry section of model, 15:48586 (R;CS;In Russian)
Held, B.J., Respirator standards, regulations, and approvals in the USA, 15:49168 (R;US)
Held, J., Krypton-85 concentration in the atmosphere, 15:49460 (RA;DE;In German)
Hemmick, T.K., *See* Debbe, R., 15:49323
See Fischer, J., 15:49267
Hemming, J.E., *See* Hamley, P.T., 15:48149
Hemphill, R.C., *See* Nieves, L.A., 15:48255
Henderson, R.F., *See* Mauderly, J.L., 15:49721
Hendra, I.R.F., Procuring, maintaining and using equipment: the key issues in controlling exposure to patients: Tolerances, limiting values and appropriate measuring methods, 15:49661 (RA;GB)
Hendricks, F.S., *See* Kimber, C.T., 15:49569
Hendricks, J.S., Monte Carlo next-event estimates from thermal collisions, 15:50060 (R;US)

Random number stride in Monte Carlo calculations, 15:50103 (R;US)
See Forster, R.A., 15:49376
Hennig, D., Experience of participants from the German Democratic Republic in DBA analysis for WWERs in the framework of the IAEA regional programme RER/9/004: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48546 (RA;XA)
Henninger, R.J., *See* Maudlin, P.J., 15:48886
Henriksen, G.L., *See* Patil, P.G., 15:48838
Henry, D.M., *See* Lawson, L.O., 15:48110
Henry, K.H., *See* Kouts, C.A., 15:49174
Hensel, J.P., *See* Lawson, L.O., 15:48110
Henshaw, E.T., Practical aspects of uniformity and intercomparison of quality control tests: Tolerances, limiting values and appropriate measuring methods, 15:49668 (RA;GB)
See Julius, H.W., 15:49667
Herhal, A.J., Assessment of physical coal-cleaning practices for sulfur removal. Final report, April 1986-January 1990, 15:48073 (R;US)
Herkenrath, H., PISC III: Third programme for the inspection of steel components: Summary report, 15:48606 (RA;XA)
Herndon, J.N., *See* Burch, W.D., 15:48224
Herrmann, A., *See* Rainer, H.-D., 15:50148
Herrmann, P.C., *See* Woodward, J., 15:49642
Hertzog, D.W., Can a Pb/SCIFI calorimeter survive the SSC?, 15:49286 (R;US)
Herzog, J.P., *See* Dunn, F.E., 15:48641
Heske, A., CO infrared bands in atmospheres of long-period variables: Proceedings of the 22. Eslab Symposium, 15:49783 (RA;FR)
Hess, D.W., *See* Wise, J., 15:49370
Hess, J.W., *See* Hurst, T.L., 15:49592
Hetherington, J.H., *See* Bernier, M.E.R., 15:49866
Hettergott, E., *See* Baxter, A.M., 15:48573
Heuer, D., Study of the linear momentum transfer distribution in the ^{40} Ar + ^{12}C system at 27, 32, 36, 40, 44 and 60 MeV/A, 15:49998 (R;FR;In French)
Hewitt, K.J., *See* Sladen, J.A., 15:49199
Heywood, A.C., Robotic requirements for plutonium handling automation, 15:49176 (J;US)
Hickman, R.J., *See* Hawke, R.S., 15:49167
Hickox, C.E., A numerical study of convection in a layered porous medium heated from below, 15:48478 (R;US)
Hickson, C.J, A new Frontier Geoscience Project: Chilcotin-Nechako region, central British Columbia, 15:48128 (RA;CA)
Hidaka, Y., *See* Le, L.P., 15:48923
Hidalgo, C., *See* Ritz, C.P., 15:50112
Higgins, E.C., Climate change and energy use: Role of renewable energy sources, 15:49430 (RA;US)
See Chung, F., 15:49431
Higuchi, Kenji, Monte Carlo codes and Monte Carlo simulator program, 15:50221 (R;JP;In Japanese)
Hill, C.V., Operational considerations in specifying legal weight vehicles for the highway transport of spent nuclear fuel: Volume 1, 15:48381 (BA;US)
Hill, H.A., *See* Rabaey, G.F., 15:49844
Hill, J., Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): Striped bass, 15:49588 (R;US)
Hillis, D.L., *See* Harris, J.H., 15:50132
Hillsman, E., *See* Chung, F., 15:49431
Hilse, H., *See* Hennig, D., 15:48546
Hindmarsh, M., *See* Copeland, E.J., 15:49823
Hinkebein, T.E., *See* Fernandez, J.A., 15:48323
Hinks, D.G., *See* Dabrowski, B., 15:48910
Hinshaw, S.M., A practical approach to ballistic deficit correction, 15:49335 (J;US)
See Goulding, F.S., 15:49339
Hintsa, E.J., *See* Zhao, X., 15:49141
Hirabayashi, Takakuni, *See* Saeki, Masakatsu, 15:49149
Hiraga, Keijiro, *See* Watanabe, Katsutoshi, 15:48882
Hirano, Masashi, Development of THYDE-HTGR: computer code for transient thermal-hydraulics of high-temperature gas-cooled reactor, 15:48575 (R;JP)
Hirata, Masaru, *See* Fukushima, Susumu, 15:48997
See Yahata, Taneaki, 15:48283
Hirata, Shoichi, *See* Sakaguchi, Harutaka, 15:49317
Hirayama, Toshio, *See* Kamada, Yutaka, 15:50156
Hiroe, S., *See* Harris, J.H., 15:50132
Hiromoto, R., A Monte Carlo boundary propagation method for the solution of Poisson's equation, 15:50225 (R;US)
Hirschon, A.S., Exploratory coprocessing research: Quarterly report No. 7, March 1, 1990–May 31, 1990, 15:48077 (R;US)
Hirst, E., Electricity: Getting more with less, 15:48802 (J;US)
Hiruma, A., *See* Dilmanian, F.A., 15:49346
Hjardemaal, O., Organizing quality control programmes: Tolerances, limiting values and appropriate measuring methods, 15:49660 (RA;GB)
Ho, C.M., Study of asymmetric supersonic jet flow for ejectors, 15:48805 (R;US)
Ho, P.T.P., *See* Beck, S.C., 15:49797
Ho, Y.A., The effects of brine contamination on volume change behavior of fine grained soils: Proceedings, 15:48166 (RA;CA)
Hobart, M., *See* Roberts, T.M., 15:50097
Hochella, M., *See* Tingle, T.N., 15:48179
Hock, S.M., Performance and cost projections for advanced wind turbines, 15:48483 (R;US)
Hodapp, K.W., *See* Eiroa, C., 15:49782
Hodges, T.A., *See* Beveridge, J.L., 15:49265
Hodgson, K.O., *See* Iwanczyk, J.S., 15:49325
Hoehn, J., Verification of computer codes used in licensing: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48587 (RA;XA)
Hoeschen, D., Film-screen characteristics: Tolerances, limiting values and appropriate measuring methods, 15:49684 (RA;GB)
See Kramer, H.M., 15:49671
Hoff, C., *See* Stoutland, P.O., 15:49057
Hoff, J., *See* Swoboda, C., 15:49336
Hoffman, C.M., *See* Ziock, H.J., 15:49374
Hoffman, E.J., 3-D phantom to simulate cerebral blood flow and metabolic images for PET, 15:49701 (J;US)
See Digby, W.M., 15:49347
See Germano, G., 15:49700
See Guerrero, T.M., 15:49699
See Strother, S.C., 15:49350
Hoffman, K.R., *See* Gunter, D.L., 15:49703
Hoffman, Yehuda, Isocurvature baryon-dominated open universe - Structure of galactic halos, 15:49849 (J;US)
Hoffmann, E.L., *See* Giles, M.S., 15:48372
Hoffmann, W., A computer program system for the analysis of 3-d steady flows in turbomachinery components, 15:49178 (R;DE;In German)
Hofman, G.L., *See* Rest, J., 15:48217, 15:48218
Hogan, A., *See* Kent, J., 15:49322
Hokin, S.A., *See* Sprott, J.C., 15:50115
Holahan, P.K., Survival of Chinese hamster ovary cells following ultrahigh-dose-rate electron and bremsstrahlung radiation. Final report, September 1988-February 1989, 15:49707 (R;US)
Holland, S., A monolithically integrated detector-preamplifier on high-resistivity silicon, 15:49342 (J;US)
See Haber, C., 15:49273
Hollen, R.M., *See* Beugelsdijk, T.J., 15:49644
Holly, D.J., *See* Sprott, J.C., 15:50115
Holman, W., *See* Brown, M.J., 15:49213
Holmes, J.A., *See* Ritz, C.P., 15:50112
Holroyd, R., Effects of radiation damage to ionization chamber liquids, 15:49372 (J;US)
Holstein, P.A., *See* Galmiche, D., 15:50166
Holter, G.M., Planning for future waste storage and transport requirements, 15:48825 (R;US)
Holtkamp, D., *See* Ziock, H.J., 15:49374
Homeny, J., Effect of interfacial characteristics on the mechanical performance of ceramic-ceramic composites. Final report, July 1986-December 1989, 15:48906 (R;US)
Hooper, H.H., Correlation of liquid-liquid equilibria for some water-organic liquid systems in the region 20-250°C, 15:49071 (RA;US)
High-temperature mutual solubilities for some binary and ternary aqueous mixtures containing aromatic and chlorinated hydrocarbons, 15:49069 (RA;US)

Hoopes, B.L., *See* Droppo, J.G. Jr., 15:49547, 15:49548, 15:49583
Hooren, D.L. Van, Handling and curing peanuts in modified tobacco bins, 15:48822 (R;CA)
Irrigation pumping plant evaluation: Interim report, 15:48820 (R;CA)
Methods to utilize tobacco kilns for curing (drying) and/or storage of alternate crops: Interim report. 1988 year, 15:48821 (R;CA)
Sealing and insulating specific areas of bulk tobacco kilns: Final report, 15:48812 (R;CA)
Hooton, R.D., Case studies of Ontario Hydro's experience with standard tests for alkali-aggregate reactivity, 15:49188 (RA;CA)
Hopkins, D., *See* Meyer, L.R., 15:48343
Horche, K., *See* Hennig, D., 15:48546
Horrigan, S.G., *See* Capone, D.G., 15:49639
Horton, L.D., *See* Harris, J.H., 15:50132
Horton, W., *See* Kim, Jin-Yong, 15:50119
Horvath, I.T., *See* Baralt, E., 15:48082
Horwitz, E.P., The TRansUranium EXtraction (TRUEX) process: A vital tool for disposal of US defense nuclear waste, 15:48257 (R;US)
Horwitz, N., *See* Woody, C.L., 15:48940
Hosking, F.M., Solderability of environmentally exposed Sn-plated surfaces, 15:48897 (R;US)
Hosogane, Nobuyuki, *See* Kamada, Yutaka, 15:50156
Hosoyamada, Ryuji, *See* Nakamura, Takehiko, 15:48583
Hossain, M.S., *See* Cook, W.J., 15:48504, 15:48505, 15:48506, 15:48507, 15:48508
Hossain, S., *See* Cook, W.J., 15:48503
Hovda, P.D., *See* Kihlstrom, K.E., 15:48889
Howard, W.M., A new site for the astrophysical gamma-process: Revision 1, 15:49836 (R;US)
Howe, H.C., *See* Harris, J.H., 15:50132
Howe, M.A., *See* Saboungi, M.L., 15:48949
Howell, B.T, *See* Riddersma, J.A., 15:48786
Hoy, G.R., SDIO/1st ultrashort wavelength laser - novel experimental schemes for observing the Moessbauer Effect in long-lived nuclear levels and nuclear coherent states. Final technical report for period ending 26 May 1990, 15:49200 (R;US)
Hoyle, F., A unified model for the 3.28 μ m and 3.4 μ m spectral feature in the interstellar medium and in comets: Proceedings of the 22. Eslab Symposium, 15:49757 (RA;FR)
The microwave background in steady-state cosmology: Proceedings of the 22. Eslab Symposium, 15:49800 (RA;FR)
See Wickramasinghe, N.C., 15:49758
Hrycyk, M., *See* Haber, C., 15:49273
Hsiao-Ying, Chao, Measurement of α_s from energy-energy correlations in e^+e^- annihilation at 29 GeV, 15:49912 (R;US)
Hsieh, H., *See* Murphy, J.B., 15:49275
Hsu, S.N., *See* Xia, W., 15:48951
Hu, C.Y., Resonances in muonic systems, 15:50194 (RA;GB)
Hu, Q., Quasiparticle mixers and detectors, 15:49319 (BA;US)
Hu, Y., Molecular thermodynamics of partially ordered fluids: Microemulsions, 15:49067 (RA;US)
Huang, W., *See* Taddeucci, T.N., 15:50000
Hubbard, A.T., Electrocatalyst surfaces. Final report, December 1986-November 1989, 15:48762 (R;US)
Huber, J., *See* Cavalli-Sforza, M., 15:49359
Huber, W.J., Proceedings of the second annual fuel cells contractors review meeting, 15:48760 (R;US)
Hubert, F., Beta decay of ^{22}O, 15:50002 (R;FR)
See Bazin, D., 15:50003
Huffman, M.A., The chemistry of (fulvalene)-molybdenumruthenium(pentacarbonyl), 15:49054 (RA;US)
Huggins, R.A., *See* Burmester, C.P., 15:48932
Hughes, R.C., Catalytic gated semiconductor devices as gas sensors, 15:48980 (BA;US)
Hughes, S.A., *See* Hertzog, D.W., 15:49286
Hughes, W.J., *See* Lester, M., 15:49857
Hultric, R., Modelization of the energy demand. Application to the OECD countries, 15:48697 (R;FR;In French)
Hull, J.R., *See* Wu, J.L., 15:49205
Hull, W.E., Conversational Monitor System (CMS) at Argonne National Laboratory (ANL): Revision 2, 15:50212 (R;US)
Humes, D.H., *See* Williams, M.D., 15:48467
Hunt, J.A., Stratigraphy, organic maturation, and source rock potential of Cretaceous strata in the Chilcotin-Nechako region (Nazko Basin), British Columbia, 15:48127 (RA;CA)
Hunt, L., A search for the CO feature in active galactic nuclei: Proceedings of the 22. Eslab Symposium, 15:49801 (RA;FR)
Hunter, T.O., Important factors in developing a nuclear waste management system: Volume 1, 15:48350 (BA;US)
Huntington, G.S., *See* Essington, M.E., 15:48202
Hupp, J.T., Intramolecular electron transfer rates: Three year progress report, 15:49124 (R;US)
Huq, S., Global warming and Bangladesh: Implications and responses, 15:49453 (RA;US)
See Gustafson, P., 15:49440
Hur, N., *See* McCarley, R.E., 15:48937
Hurlbut, C., *See* Zorn, C., 15:49369
Hurley, K., *See* Parsons, A., 15:49345
Hurst, T.L., Red Canyon wash infiltration studies, 15:49592 (R;US)
Hurtak, O., *See* Klima, R., 15:50147
Hussain, H.A., Kuwait Petroleum Corporation: New horizons for national oil companies, 15:48140 (RA;CA)
Hussain, Z., *See* Leung, K.T., 15:48962
See Terminello, L.J., 15:48963
Hutchins, G.D., Constrained least squares filtering in high resolution PET and SPECT imaging, 15:49349 (J;US)
Hutton, R., Double and single electron capture in slow collisions of $Ar^{9,8+}$ ions with He atoms, 15:49889 (RA;US)
Hwang, Y., Mass transport in bedded salt and salt interbeds: Volume 1, 15:48304 (BA;US)
Hybertsen, M.S., *See* Zhang, S.B., 15:50085

I

Ibanez-Meier, R., Nuclear magnetic resonance survey of hydrogen motion and electronic structure in α-phase (Nb-Mo)-H alloys, 15:50075 (R;US)
Ibn-Khayat, M., SPERT-II benchmarks of a dynamic model for the advanced neutron source reactor, 15:48671 (J;US)
Ice, G.E., *See* Sparks, C.J., 15:49187
Ichinose, Ikuo, *See* Yamamoto, Hisashi, 15:48917
Ierusalimov, A.P., Interference of the main diagrams of OPER-model for reaction $np \rightarrow np\ \pi^+\pi^-$ at energies 1-5 GeV: Collection, 15:50035 (RA;SU;In Russian)
Ignatyuk, A.V., *See* Blokhin, A.I., 15:50009
Iguchi, Tadashi, *See* Okubo, Tsutomu, 15:48657
Igumnov, M.M., *See* Shvedov, O.V., 15:48627
Iida, H., *See* Dilmanian, F.A., 15:49346
Ikeda, Hirokazu, Trigger/front end electronics and data collection, 15:49262 (RA;JP;In Japanese)
Ikeda, N., *See* Kubono, S., 15:50004
Ikeda, Nobuo, *See* Komori, Fumio, 15:50072
Ikeda, Susumu, Direct observation of hydrogen wave functions, 15:49878 (RA;JP)
Ikehata, Seiichiro, *See* Komori, Fumio, 15:50072
Ikezoe, Hiroshi, Report of the seminar on nuclear physics and atomic physics at the JAERI tandem-booster accelerator, 15:49259 (R;JP)
Imaida, T., Development of the fuzzy control system for heat-pump air conditioners, 15:48791 (R;JP)
Imakuma, K., *See* Borges, J.F.A., 15:48875
Imel, G.R., Neutron beam characterization at the Neutron Radiography Reactor (NRAD), 15:48402 (R;US)
The Neutron Radiography Reactor (NRAD), 15:48620 (R;US)
Immonen, O., Electrostatic precipitators, 15:49555 (RA;FI)
Ingelbrecht, C., *See* Pauwels, J., 15:48994
Ingrosso, G., *See* Ceccarelli, C., 15:49781
Inuzuka, E., *See* Dilmanian, F.A., 15:49346
Inyakin, A.V., *See* Donskov, S.V., 15:49298
Ionov, A.I., Large nuclear reactor transient simulation: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48574 (RA;XA)
Iosseliani, D.D., *See* Bobylev, A.V., 15:49258
Iribarne, J.-V., *See* Cho, H.-R., 15:49473
Irving, P., *See* Chiang, Shan-Hsin, 15:49436

Isaacs, C.F.W, Effects on the environment of the fuels we are using, 15:48746 (RA;CA)
Isabel, D., *See* Locat, J., 15:49586
Ise, Takeharu, Present status and subjects of research on safety design of medium and small size power reactors, 15:48598 (RA;JP;In Japanese)
Ishihara, T., μCF studies in University of Tsukuba, 15:50193 (RA;GB)
Isied, S.S., *See* Ogawa, M.Y., 15:49648
Iskander, S.K., *See* Naus, D.J., 15:48608
Isler, R., *See* Ritz, C.P., 15:50112
Isler, R.C., *See* Harris, J.H., 15:50132
Isono, Takaaki, *See* Konno, Masayuki, 15:49279
Isotani, S., Luminescence study of spodumene, 15:50071 (R;BR)
Itabashi, Takahisa, Circulation ring and mass screening of unstable nucleus, 15:49280 (RA;JP;In Japanese)
Itoh, K., Effect of confinement of SoL plasma on core temperature profile, 15:50161 (R;JP)
Loss cone region in toroidal helical systems, 15:50181 (R;JP)
Itoh, S.-I., *See* Itoh, K., 15:50161, 15:50181
Ivanov, G.N., *See* Burtebaev, N.T., 15:49989
Ivanov, I.V., *See* Bugarya, V.I., 15:50140
Ivanova, A., *See* Balabanov, E., 15:48555
Ivkin, A.V., Probable method of $W^{\pm}$-boson mass and widths measurements: 1. High energy physics and computer technique, 15:49954 (RA;SU;In Russian)
Iwamura, Takamichi, *See* Okubo, Tsutomu, 15:48657
Iwanczyk, J.S., The HgI_2 energy dispersive x-ray array detectors and minaturized processing electronics project, 15:49325 (J;US)
Iwasawa, Kazuo, *See* Sakata, Fumihiko, 15:50031
Iwata, Yousei, Gamma ray from highly excited ^{190}Hg and ^{110}Sn, 15:50014 (RA;JP;In Japanese)

J

Jacmart, J.C., *See* Bazin, D., 15:50003
Jacob, A.F., On the beam impedance of shallow tapered cavities, 15:49236 (R;US)
Jacobs, J.A., *See* Gardner, J.E., 15:48853
Jacobs, J.J., *See* Eddy, B.T., 15:49024
Jacobson, D.A., *See* , 15:49647
See Brown, G.M., 15:49647
Jacobson, R.D., *See* Wemple, R.P., 15:49742
Jacq, F., *See* Chatelard, P., 15:48534
Jacquemin, R.A., *See* Constant, R.J., 15:48636
Jacquemot, S., Satellite lines of neon-like resonance lines for $17<Z<48$, 15:50110 (R;FR)
Jacques, P., *See* Cavalli-Sforza, M., 15:49359
Jager, D., *See* Tangler, J., 15:48484
Jaklevic, J.M., *See* Madden, N.W., 15:49330
Jakubka, K., *See* Stoeckel, J., 15:50143
See Zacek, F., 15:49876
Janaradanan, C., *See* Kartha, P.K.S., 15:48222
Jankowiak, R., Fluorescence line-narrowing spectral analysis of in vivo human hemoglobin-benzo[a]pyrene adducts: Comparison to synthetic analogues, 15:49646 (BA;US)
Jannson, T., Holographic rugate structures for x-ray optics applications: Phase 2 Annual report, 15:49153 (R;US)
Janssens, R.V.F., *See* Khoo, T.L., 15:50011
Jantunen, M.J., Atmospheric fates of air pollutants, 15:49551 (RA;FI)
Janus, J.A., *See* Montizaan, G.K., 15:49725
See Slooff, W., 15:49724
Jardine, L.J., The use of performance assessments in Yucca Mountain repository waste package design activities: Volume 1, 15:48354 (BA;US)
See Ma, C.W., 15:48317, 15:48374
Jarvinen, G.D., *See* Hay, B.P., 15:49091
Jastrow, J., *See* Johnson, D., 15:49567
Javandel, I., Hydrologic characterization of faults and other potentially conductive geologic features in the unsaturated zone: Volume 1, 15:48348 (BA;US)
Jean, D., *See* Hubert, F., 15:50002
Jeanloz, R., *See* Cohen, M.L., 15:50086
See Knittle, E., 15:49079
Jeffers, B.W., *See* Weier, D.R., 15:48393
Jenkins, M.L., *See* King, S.L., 15:48862
Jenkovszky, L.L., *See* Grdlichka, E.S., 15:49947
Jensen, E.J., *See* Last, G.V., 15:49741
Jensen, G.L., *See* Jones, S.E., 15:50200
Jerzykiewicz, A., *See* Bielik, M., 15:49366
Jesih, A., *See* Zemva, B., 15:49099
Jessen, K.A., Quality control in quantitative computed tomography: Tolerances, limiting values and appropriate measuring methods, 15:49681 (RA;GB)
Jesson, D.E., *See* Pennycook, S.J., 15:48952
Ji, Li, *See* Finnemore, D.K., 15:48921
Jialin, Xie, *See* Batchelor, K., 15:49225
Jinke, Tang, Physical metallurgy and magnetic behavior of Cd stabilized bcc (beta)Gd alloys, 15:48881 (R;US)
Jo, J., *See* LeBaron, B.A., 15:48442
See Rohatgi, U.S., 15:48664
Joel, D.D., *See* Dilmanian, F.A., 15:49346
Joensson, Lennart, Views on the calculation of flow and dispersion processes in fractured rock, 15:48290 (R;SE)
Joergensen, J., *See* Jessen, K.A., 15:49681
Johansson, I.B., *See* Naus, D.J., 15:48608
Johnson, A.B. Jr., *See* Bailey, W.J., 15:48370
Johnson, C., *See* Majkrzak, C.F., 15:48857
Johnson, D., Reuse of incinerated soil residues in land reclamation, 15:49567 (R;US)
Johnson, E.W., Galileo light-weight radioisotope heater units design and safety analysis, 15:48408 (R;US)
Johnson, G., *See* Lindquist, D.H., 15:48947
Johnson, G.K., *See* Saboungi, M.L., 15:48868
Johnson, G.L., Validating data from instruments in harsh environments: The designer's dilemma, 15:48615 (J;US)
Johnson, G.M., *See* Mirchandani, M.G., 15:49416
Johnson, K.F., *See* Hertzog, D.W., 15:49286
Johnson, P., A passive solar heating facility for existing houses: Demonstration project: Final report, 15:48473 (R;LU)
Johnson, P.E., *See* Danese, F.L., 15:48241
Johnson, R.L., The effect of freezing and thawing on the dewatering of oil sands sludges: Volume 2, 15:48209 (RA;CA)
Johnson, S.M., *See* Loehman, R.E., 15:48943
Johnson, W.H., Molten carbonate fuel cell power plant systems studies, 15:48490 (R;US)
Johnston, D.C., *See* Le, L.P., 15:48923
Johnston, H., *See* Dayal, R., 15:48285
Johnston, H.S., Use of excess carbon-14 data to test 2D stratospheric models, 15:49462 (RA;US)
See Darwin, D.C., 15:49039
Johnston, J.B., Texas Barrier Islands Region ecological characterization atlas: Biological resources narrative, 15:49570 (R;US)
Jones, A.P., *See* Brennan, A.G., 15:49669
Jones, C., *See* Gustafson, P., 15:49440
Jones, C.B., Sea-level rise: Assessing the scientific debate, 15:49437 (RA;US)
Jones, E.D., Nonparabolic conduction bands and masses in strained-single-quantum wells, 15:48975 (R;US)
Photoluminescence studies of $In_xGa_{1-x}As/Al_yGa_{1-y}As$ strained-layer structures: Effects of annealing, 15:48976 (R;US)
See Lyo, S.K., 15:49892
See Reno, J.L., 15:48978
Jones, G.K., Managing local socioeconomic impacts through project management policies concerning subsidized transportation, site access, and on-site housing: Volume 1, 15:48313 (BA;US)
Jones, K.R., *See* Kelly, D.L., 15:48667
Jones, L., *See* Kinch, R., 15:49504, 15:49505, 15:49514
Jones, R.H., *See* Best, R.E., 15:48237
Jones, R.L., *See* Munson, D.E., 15:48368
Jones, R.W., *See* McClelland, J.F., 15:48996
Jones, S.E., Response to queries regarding "Observation of cold nuclear fusion in condensed matter", 15:50200 (RA;GB)
Review of μCF and new LAMPF results, 15:50184 (RA;GB)
Jong, R.A., *See* Shay, H.D., 15:49238
Jong, T. de, Infrared spectroscopy of late-type stars: Proceedings of the 22. Eslab Symposium, 15:49776 (RA;FR)
Jordan, H., *See* Denning, R.S., 15:48663

See Thornhill, C.K., 15:48221
Jorgensen, J.D., *See* Dabrowski, B., 15:48910
See Lightfoot, P., 15:48913
Jose, J.M., A study on the recovery of uranium from low grade vein deposits: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988, 15:48254 (RA;XA)
Spanish yellow cake production by bioleaching: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988, 15:48214 (RA;XA)
Joseph, R.D., Near-infrared spectroscopy of starburst and interacting galaxies: Proceedings of the 22. Eslab Symposium, 15:49795 (RA;FR)
See Doyon, R., 15:49798
Joshi, Chan, Advanced accelerator concepts, 15:49226 (B;US)
Jou, W.H., *See* Ho, C.M., 15:48805
Jourdain de Muizon, M., A survey of PAH emission in HII regions, planetary and proto-planetary nebulae: Proceedings of the 22. Eslab Symposium, 15:49784 (RA;FR)
Polycyclic aromatic hydrocarbons in the infrared spectra of IRAS sources: Proceedings of the 22. Eslab Symposium, 15:49765 (RA;FR)
Joy, D.S., *See* Andress, D., 15:48366
See Danese, F.L., 15:48241
See Vogel, L.W., 15:48365
Julius, H.W., An overview of the International Electrotechnical Commission's activities on quality assurance in diagnostic radiology: Tolerances, limiting values and appropriate measuring methods, 15:49667 (RA;GB)
See Henshaw, E.T., 15:49668
Jung, J., *See* Blacker, T.D., 15:50241
Juranl, R.S., Ventilation design for the Exploratory Shaft Facility Yucca Mountain Project: Volume 1, 15:48376 (BA;US)
Jyske, P., *See* Saeteri, J., 15:48796

K

Kack, G.J., Use of drainage wicks for an embankment on slickensided clay: Proceedings, 15:48498 (RA;CA)
Kadono, R., Spin dynamics of the itinerant helimagnet MnSi studied by positive muon spin relaxation, 15:50029 (R;JP)
Kadoyu, M., *See* Uchiyama, Y., 15:48685
Kadyk, J.A., *See* Wise, J., 15:49370
Kadyshevskij, V.G., On a generalization of the gauge principle at high energies, 15:49972 (R;SU;In Russian)
Kaekoenen, J., *See* Kasanen, P., 15:48742
Kaerkkaeinen, S., *See* Etula, H.J., 15:50236
Kahler, J.P., Calculating toxic corridors. Revision. Technical report, 15:49415 (R;US)
Kahn, E., Least-cost planning for Pacific Gas and Electric: Stage 1: Load Management Strategy Testing Model (LMSTM) calibration, 15:48751 (R;US)
Kakurin, A.M., *See* Volkov, V.V., 15:50127
Kalia, H.N., Prototype testing for the Yucca Mountain project: Volume 1, 15:48335 (BA;US)
Role of underground testing to determine suitability of Yucca Mountain as a potential repository site: Volume 1, 15:48299 (BA;US)
Kaliaguine, S., *See* Lemieux, R.R., 15:48421
Kallend, J.S., *See* Kocks, U.F., 15:48887
Kallinger, W., Methods of measurement, accuracy and tolerable deviations: Tolerances, limiting values and appropriate measuring methods, 15:49665 (RA;GB)
Kalpakchieva, R., *See* Oganesyan, Yu.Ts., 15:49991
Kalsi, S., *See* Murphy, J.B., 15:49275
Kaluzniacki, A., *See* Ziock, H.J., 15:49374
Kalvins, A, Atmospheric corrosion of transmission line conductors: Literature review, 15:48676 (R;CA)
Kamada, Yutaka, Density limit in JT-60, 15:50156 (R;JP)
Kamat, P.V., Picosecond charge-transfer events in the photosensitization of colloidal TiO_2, 15:48983 (J;US)
Kamenskij, K.K., Geometrical and dynamical characteristics of the Earth, the Moon and Terrestrial planets. Part 1: 1.Topographic surfaces and Gravitational fields, 15:49812 (R;UA;In Russian)
Kamigaito, Osamu, Inelastic proton scattering from deformed nuclei at intermediate energy, 15:50049 (RA;JP;In Japanese)
Kamimoto, M., Latent thermal energy storage using form-stable high-density polyethylene, 15:48475 (R;JP)
Kamimura, T., *See* Itoh, K., 15:50181
Kaminaga, Masanori, *See* Sudo, Yukio, 15:49185
Kamionkowski, M., Thermal relics: Do we know their abundances, 15:49822 (R;US)
Kamitani, Takuya, Measurement of Bs-Bs-bar mixing, 15:49914 (RA;JP;In Japanese)
Kammel, P., *See* Zmeskal, J., 15:50183
Kamo, T., Preparation and structural characterization of Tl-Sr-Ca-Cu-O superconducting materials, 15:48934 (R;JP)
Kanari, K., *See* Kamimoto, M., 15:48475
Kaneshevich, V.I., *See* Burtebaev, N.T., 15:49989
Kandler, R.A., *See* Kahler, J.P., 15:49415
Kang, H.C., *See* Schmitz, P.J., 15:48878
Kang, N., *See* Brosseau, G., 15:48449
Kaper, H.G., *See* Garbey, M., 15:50215
Kaper, T.J., Transport, mixing and stretching in a chaotic Stokes flow: The two-roll mill, 15:49898 (R;US)
Kaplan, S.N., *See* Cho, G., 15:49356
See Fujieda, I., 15:49324
Kappel, M.J., *See* Zhu, D.H., 15:49059
Karabekov, I.P., Basic circuit of synchrotron power supply on standard units, 15:49247 (R;SU)
See Akopyan, V.P., 15:49246
Karagezyan, G.V., *See* Avakyan, V.V., 15:49288
Karasaki, K., Building of a conceptual model at the UE25-c hole complex: Volume 1, 15:48339 (BA;US)
Kardanov, A.B., *See* Kazakov, P.N., 15:50217
Kareev, Yu.A., *See* Zayatdinov, R.M., 15:50175
Kargal'tsev, V.V., Interface for the local net B0612, 15:49208 (R;SU;In Russian)
Kartasheva, V.G., *See* Gorin, Yu.P., 15:49307
Kartha, P.K.S., Purification of degraded TBP solvent using macroreticular anion exchange resin, 15:48222 (R;IN)
Kasanen, P., International risk factors affecting Finnish energy supplies, 15:48742 (R;FI;In Finnish)
Kaschak, W.M., *See* Gilroy, D.G., 15:49531
Kasperczuk, A., *See* Veresczinski, Z., 15:50135
Kastrup, R.V., *See* Baralt, E., 15:48082
Katerinchuk, P.A., A three-dimensional model of separable potential interaction at high energies, 15:49943 (R;UA;In Russian)
Kato, Hiroo, *See* Yoshimoto, Yasuhiko, 15:49717
Kato, Takako, Plasma diagnostics and atomic processes, 15:50162 (R;JP)
Katragadda, S., *See* Celik, I., 15:48109
Katsumoto, Shingo, *See* Komori, Fumio, 15:50072
Katti, A.M., *See* Czok, M., 15:49026
Katz, A., Supercomputer work-station communication. Special report, 15:50209 (R;US)
Kauffman, J., *See* Kennedy, C., 15:49329
Kauffman, J.M., High-pulse-energy flashlamp pumpable laser dyes. Interim technical report, 1 October 1989-31 March 1990, 15:49204 (R;US)
Kaufmann, H.H., *See* Brunner, J., 15:49928
Kauppinen, E.I., Size distribution measurement of particles in flue gases, 15:49550 (RA;FI)
Kauppinen, P., *See* Toerronen, K., 15:48521
Kawabata, Yuji, *See* Suzuki, Masatoshi, 15:48631
Kawabe, U., *See* Nishino, T., 15:49215
Kawai, Takeshi, Cold neutron source as heat pipe, 15:49182 (RA;JP;In Japanese)
Kawaratani, K., *See* Sakaguchi, I., 15:48487
Kazakov, P.N., Distributed computer system based on local area network ALISA in experimental investigations, 15:50217 (R;SU;In Russian)
Kazaryan, S.P., Optimal transition X radiation detectors for particle identification in a wide energy range, 15:49290 (R;SU;In Russian)
Kazem, S.M., Thermal conductivity of metals, 15:48892 (RA;US)
Keane, A.T., *See* Strauss, M.G., 15:49352
Keane, J., *See* Murphy, J.B., 15:49275

Kechechyan, A.O., Automodality of proton cluster distributions in the range of the first intermediate asymptotics: Collection, 15:50036 (RA;SU;In Russian)
Kechyan, K.P., *See* Balayan, Z.K., 15:49291
Keddy, C.J., Environmental data bases for State of the Environment reporting: Conservation and Protection Headquarters. Technical Report Series No. 9, 15:48704 (R;CA)
Kee, R.J., *See* Bilger, R.W., 15:48438
Keeney-Walker, J., *See* Naus, D.J., 15:48608
Kehoe, R.B., Enrichment and fuel cycle developments: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988, 15:48250 (RA;XA)
Kellmann, F., *See* Navarro, H., 15:48966
Kelnaenen, H., *See* Toerronen, K., 15:48521
Kelr, D., An appreciation of the events, models and data used for LMFBR radiological source term estimations, 15:48650 (R;FR)
Kelkar, S., Modeling of coupled heat-mass stress effects in geologic media: Volume 1, 15:48342 (BA;US)
Keller, M.M., Biological sources and sinks of methane in tropical habitats and tropical atmospheric chemistry. Doctoral thesis, 15:49532 (R;US)
Kelly, D.L., An analysis of containment venting as a severe accident mitigation strategy for the BWR Mark II containment, 15:48670 (J;US)
Quantitative analysis of potential performance improvements for the dry PWR [pressurized water reactor] containment, 15:48667 (R;US)
Kelly, R.F., *See* Denning, R.S., 15:48663
Kelveno, C., *See* Edmonds, J., 15:49424
Kenik, E.A., Analytical electron microscopy studies of radiation damage, 15:48899 (J;US)
Kennedy, C., New scintillation materials for high energy physics applications, 15:49329 (J;US)
Kennedy, C.R., Irradiation creep of graphite, 15:48600 (R;US)
Kennedy, D.J., *See* Klinowski, G.W., 15:48101
Kenski, D., *See* Edmonds, J., 15:49424
Kenski, D.M., *See* Streets, D.G., 15:49429
Kent, J., Design of a wire imaging synchrotron radiation detector, 15:49322 (J;US)
See Rouse, F., 15:49272
See Von Zanthier, C., 15:49268
Kephart, R., *See* Haber, C., 15:49273
Kerbikov, B.O., Topics in low-energy p-barp interactions, 15:49942 (R;SU)
Kerby, J.S., *See* Bossert, R.C., 15:49250
Kerby, M.C., Models for organometallic polymers: Zigzag chains of $Mo_2(O_2CCH_3)_4$ units linked by dimethylphospinoethane (dmpe) and tetramethylethylenediamine (tmeda) ligands, 15:49055 (RA;US)
Kerchner, H.R., [19th international conference on low-temperature physics]: Foreign trip report, August 15–25, 1990, 15:50089 (R;US)
Kereselidze, A.R., *See* Amaglobeli, A.N., 15:49931
Kerl, F.A., *See* Gibson, J.D., 15:48309
Kern, K.T., Dynamic mechanical analysis of polymeric materials, 15:48968 (RA;US)
Kerrou, M., *See* Barbier, M.J., 15:48764
Kershaw, G.P., *See* Evans, K.E., 15:49635
See Maslen, L., 15:48162
Kersley, L., Amplitude and phase scintillation and ionospheric irregularities at sub-auroral latitudes. Interim report, 30 September 1987-31 March 1989, 15:49855 (R;GB)
Kessler, M.F., *See* Glasse, A.C.H., 15:49750
Ketola, W.S., Vitrification of defense high level radioactive waste at Savannah River and Hanford: Volume 1, 15:48325 (BA;US)
Kettler, D.J., The TRW entrained combustor retrofit at Orange and Rockland Utilities, Lovett Station Unit 3, 15:48486 (R;US)
Keyvani, M., *See* Cook, W.J., 15:48508, 15:48509, 15:48510, 15:48511
Kharchenko, V.F., *See* Katerinchuk, P.A., 15:49943
Khazhmuradov, M.A., *See* Vorob'eva, V.P., 15:50179
Khizhnyak, N.A., *See* Zabela, A.G., 15:49235
Khlupin, S.I., About applicability of binary collisions model in the theory of ion transport in matter: 2. Solid state physics and mass transfer simulation, 15:50059 (RA;SU;In Russian)
Kholmetskaya, A.V., *See* Boos, E.G., 15:49992
Khoo, T.L., Population of superdeformed bands, the competition with fission, and the barrier between normal and superdeformed states, 15:50011 (R;US)
Khoromskij, B.N., *See* Zhidkov, E.P., 15:50101
Khoury, G.A., Effect of bacterial activity on North Sea concrete, 15:48971 (R;GB)
Khrushchev, V.V., Strange meson mass spectrum in relativistic model for quasi-independent quarks, 15:49934 (R;SU)
Kick, R., *See* Michelotti, L., 15:50216
Kiefer, T.C., *See* Olsen, K.B., 15:49638
Kierstead, J.A., *See* Woody, C.L., 15:48940
Kihlstrom, K.E., Search for nonphonon mechanisms of superconductivity, 15:48889 (RA;US)
Kikuchi, K., Development of water purification technologies for intensive fish culture. 2.: Factors affecting nitrification in marine biological filter system, 15:49590 (R;JP;In Japanese)
See Watanabe, Y., 15:49591
Kikuchi, Masahiro, *See* Sjarief, S.H., 15:49714
Kilcher, P., *See* Le Blanc, F., 15:50073
Killen, L., Impact of renewable derived fuels on energy and agriculture sectors: Final report, 15:48411 (R;LU)
Killian, K., *See* Womersley, J., 15:49293
Kilpatrick, B.L., *See* Garner, S.J., 15:48452
Kim, H.E., Effect of hydrogen-water atmospheres on corrosion and flexural strength of sintered α-silicon carbide, 15:48944 (J;US)
Optical and mechanical properties of hot-pressed cesium iodide, 15:48941 (J;US)
Kim, Jin-Yong, Effects of compressibility, diamagnetic drift, and thermal conduction on resistive ballooning modes in the second stability regime, 15:50119 (R;US)
Kimball, C.W., *See* Dabrowski, B., 15:48910
Kimber, C.T., Texas Barrier Islands Region ecological characterization atlas: Socioeconomic and natural features narrative, 15:49569 (R;US)
Kimura, K., Bioprocessing of coal. 1.: Microorganisms for coal processing, 15:48074 (R;JP;In Japanese)
Kinch, R., Amendment to best demonstrated available technology (BDAT) background document for K037. Final report, 15:49511 (R;US)
Amendment to the best demonstrated available technology (BDAT) background document for wastes from the petroleum refining industry K048, K049, K050, K051, K052. Final report, 15:48146 (R;US)
Amendment to the final best demonstrated available technology (BDAT) background document for wastes from the production of 1,1,1-trichloroethane K028, K029, K095, and K096. Final report, 15:49502 (R;US)
Amendment to the final best demonstrated available technology (BDAT) background document for distillation bottom tars from the production of phenol/acetone from cumene K022. Final report, 15:49506 (R;US)
Amendment to the final best demonstrated available technology (BDAT) background document for wastes from the production of chlorinated aliphatic hydrocarbons F024. Final report, 15:49513 (R;US)
Best demonstrated and available technology (BDAT) background document for wastes from the production of epichlorohydrin K017. Final report, 15:49606 (R;US)
Best demonstrated available technology (BDAT) background document for U and P wastes and multisource leachates. Volume D. Reactive U and P waste waters and nonwaste waters. Final report, 15:49501 (R;US)
Best demonstrated available technology (BDAT) background document for U and P wastes and multi-source leachate (F039). Volume A. Wastewater forms of organic U and P wastes and multi-source leachate (F039) for which there are concentration-based treatment standards. Final report, 15:49503 (R;US)
Best demonstrated available technology (BDAT) background document for U and P wastes and multi-source leachate (F039). Volume B. U and P wastewaters and nonwaste waters with

methods of treatment as treatment standards. Final report, 15:49504 (R;US)
Best demonstrated available technology (BDAT) background document for U and P wastes and multi-source leachate (F039). Volume C. Nonwastewater forms of organic U and P wastes and multi-source leachate (F039) for which there are concentration-based treatment standards. Final report, 15:49505 (R;US)
Best demonstrated available technology (BDAT) background document for distillation bottoms from the production of aniline K083. Final report, 15:49507 (R;US)
Best demonstrated available technology (BDAT) background document for distillation bottoms from the production of nitrobenzene by the nitration of benzene K025. Final report, 15:49508 (R;US)
Best demonstrated available technology (BDAT) background document for stripping still tails from the production of methyl ethyl pyridines K026. Final report, 15:49509 (R;US)
Best demonstrated available technology (BDAT) background document for waste-water treatment sludges generated in the production of creosote K035. Final report, 15:49510 (R;US)
Best demonstrated available technology (BDAT) background document for halogenated pesticide and chlorobenzene wastes K032-K034, K041, K042, K085, K097, K098, K105, D012-D017. Final report, 15:49512 (R;US)
Best demonstrated available technology (BDAT) background document for U and P wastes and multi-source leachate (F039). Volume E. Gaseous U and P wastes. Final report, 15:49514 (R;US)
King, G.P., Public communication and participation activities in siting controversial facilities in the United States and Western Europe: An examination of lessons learned: Volume 1, 15:48311 (BA;US)
King, J.L., Approach to developing a ground-motion design basis for facilities important to safety at Yucca Mountain: Volume 1, 15:48307 (BA;US)
King, M., *See* Kent, J., 15:49322
See Von Zanthier, C., 15:49268
King, R.S., Molecular thermodynamics of aqueous two-phase systems for bioseparations, 15:49158 (RA;US)
King, S.L., The interaction of point defects with line dislocations in HVEM [high voltage electron microscope] irradiated Fe-Ni-Cr alloys, 15:48862 (R;US)
Kingon, A.I., *See* Krauss, A.R., 15:48911
Kinner, N.E., Radon-removal techniques for small community public water supplies, 15:49633 (R;US)
Kinney, E.R., Realizations of polarized targets in storage rings, 15:49277 (R;US)
Kinnison, W.W., *See* Ziock, H.J., 15:49374
Kinoshita, Koki, *See* Yahata, Taneaki, 15:48283
Kinsley, S.A., *See* Eisenberg, D.C., 15:49061
Kiptilyj, V.G., Diagnostics of a thermonuclear plasma, based on the use of nuclear reactions, 15:50146 (RA;CS;In Russian)
Kirch, N., HTR components irradiation tests. Actual state and future requirements, 15:48634 (RA;FR;In German)
Kirk, H.G., *See* Batchelor, K., 15:49225
Kirk, M.A., *See* King, S.L., 15:48862
See Vetrano, J.S., 15:48985
Kirkpatrick, J.R., The linear solution for hydriding of uranium, 15:48883 (R;US)
Kirsten, F., *See* Wong, M., 15:49270
Kirsten, F.A., A versatile, programmable control and data acquisition system for complex integrated circuits, 15:49332 (J;US)
Kirton, J.A., *See* Coughtrey, P.J., 15:49711
Kisiyuk, V.S., *See* Kamenskij, K.K., 15:49812
Kisner, R.A., *See* Bywater, R.L., 15:48611
Kitano, K., *See* Suzuki, K., 15:48673
Kitayama, Shigeru, *See* Sjarief, S.H., 15:49714
Kivisaari, J., *See* Lamminen, J., 15:48763
Klyashko, V.A., *See* Volkov, Ya.F., 15:50158
Klyono, M., *See* Kikuchi, K., 15:49590
See Watanabe, Y., 15:49591
Kjeldgaard, E.A., Development and test case application of a waste minimization project evaluation method, 15:48726 (R;US)
Klain, G.J., Dermal penetration and systemic distribution of ^{14}C-labeled vitamin E human skin grafted athymic nude mice, 15:49656 (R;US)
Klavins, P., *See* Finnemore, D.K., 15:48921
Klein, L., *See* Fuhr, B.J., 15:48174
Klein, V.F., A radiation hardened SONOS/CMOS EEPROM family, 15:49367 (R;US)
Kleinfelder, S., *See* Haber, C., 15:49273
See Wong, M., 15:49270
See Yarema, R.J., 15:49371
Kleinfelder, S.A., A 4096 cell switched capacitor analog waveform storage integrated circuit, 15:48686 (J;US)
Kleinman, M.T., *See* Mautz, W.J., 15:49720
See Phalen, R.F., 15:49719
Klem, J.F., *See* Fritz, I.J., 15:48974
See Jones, E.D., 15:48975, 15:48976
Klem, M.D., Combustor design and analysis using the Rocket Combustor Interactive Design (ROCCID) methodology, 15:49193 (R;US)
Klima, R., Results of preliminary theoretical investigations of the lower hybrid current drive in the T-15 tokamak, 15:50147 (RA;CS;In Russian)
Klimpel, H., Field size and centring for conventional X-ray equipment: Tolerances, limiting values and appropriate measuring methods, 15:49670 (RA;GB)
Klinowski, G.W., Tracer gas used for the mine-fire simulations. Report No. CRL 89-87(TR), 15:48101 (R;CA)
Klopfer, D.C., *See* Ligotke, M.W., 15:49584
Klots, T.D., *See* Winter, B.J., 15:48865
Klotz, D., Determination of diffusion coefficients in cohesive and sandy sediment from the area of Gorleben, 15:49597 (RA;DE;In German)
Klushin, I.G., *See* Andreyev, B.A., 15:48124
Kluzniak, W., *See* Tavani, M., 15:49841
Knickerbocker, K., *See* Kennedy, C., 15:49329
Knight, J.A., Pyrolysis of biomass - A vertical flow packed-bed system: Production of char, oil and gases, 15:48428 (RA;LU)
Pyrolysis of biomass for the production of char, oil and gases, 15:48427 (RA;LU)
Knight, R.L., *See* Droppo, J.G. Jr., 15:49547
Knittle, E., Properties of cubic BN under high pressure and temperature, 15:49079 (RA;US)
Knoke, G.S., *See* Ho, C.M., 15:48805
Knowlton, T.M., Determination of flow-regime boundaries for cohesive particles: Quarterly report, September 20–December 19, 1989, 15:48210 (R;US)
Determination of flow-regime boundaries for cohesive particles: Quarterly report, December 20, 1989–March 20, 1990, 15:48211 (R;US)
Kobayashi, Shun-ichi, *See* Komori, Fumio, 15:50072
Kober, E.M., A calculational study of empirical hydrogen-bonding scales, 15:49089 (BA;US)
Kobylinskij, N.A., *See* Glushko, N.I., 15:49948
Koch, P.M., *See* Dalgarno, A., 15:49868
Kocher, D.C., Radiation protection of the public: Past, present, and future, 15:50063 (R;US)
Kocks, U.F., Accurate representations of general textures by a set of weighted grains, 15:48887 (R;US)
Kocsis, K., Technical possibilities and economic conditions of producing biomass for energy, 15:48410 (RA;LU)
Koehler, M.D., Development, application and assessment of a taxonomy for characterizing international environmental problems. Master's thesis, 15:48735 (R;US)
Koenig, R., *See* Gaudiot, G., 15:49242
Koenig, R.A., Materials of construction and corrosion history for a low-level radioactive waste incinerator, 15:48294 (B;US)
Koerber, H., Investigations of water entrainment during hypothetical reactor accidents. Final report, 15:48637 (R;DE;In German)
Kolacek, K., *See* Zacek, F., 15:49876
Kolanoski, H., *See* Ziock, H.J., 15:49374
Kolb, E.W., *See* Barrow, J.D., 15:49818
Kolbe, W.F., *See* Smith, R.C., 15:50246
Kolkunov, B.O., Nonlinear development of two-dimensional axial-symmetric MGD instability in a Z-pinch, 15:50123 (R;SU;In Russian)
Kollman, G., *See* Shapiro, B., 15:49709

Komori, Fumio, Application of in-beam perturbed angular distribution to the study of high-T_c oxides, 15:50072 (R;JP)
Kompaniets, G.V., *See* Nosov, V.I., 15:48596
Konijnenberg, M.W., *See* Abrahams, K., 15:48624
Konno, Masayuki, Manufacturing of superconducting wiggler coil, 15:49279 (R;JP;In Japanese)
Kono, H., Reaction kinetics of the CaO-SO_2 system in absence of inter-grain pore diffusion: Annual report, 15:48108 (R;US)
Kono, Y., *See* Kimura, K., 15:48074
See Nashimoto, M., 15:48702
Kononenko, W., Silcon microstrip electronics operating with 20 nsec FWHM signals, 15:49358 (J;US)
Konovalov, D.A., *See* Balashov, V.V., 15:50196
Konovalov, V.G., *See* Arsen'ev, A.V., 15:50160
Konrad, C.H., *See* Hawke, R.S., 15:49167
Koo, J., *See* McWright, G., 15:49380
Koponen, M., *See* Kasanen, P., 15:48742
Korchinskij, G.M., *See* Gvozdetskij, V.S., 15:50151
Korenev, S.A., Experimental studies of effect of high current pulse electron and carbon ion beams on high temperature Y-Ba-Cu-O, Bi-Ca-Sr-Cu-O superconductors, 15:50078 (R;SU;In Russian)
Korenman, G.Ya., Rotational and temperature effects on Coulomb capture of muons by hydrogen molecules, 15:50190 (RA;GB)
Kornblum, B.T., *See* Maltby, J.D., 15:50088
Kornfeld, K., *See* King, G.P., 15:48311
Kornilov, E.A., *See* Volkov, Ya.F., 15:50158
Kornilov, N.V., *See* Bychkov, V.M., 15:49981
Korobov, V.I., *See* Bakalov, D.D., 15:49877
Korolev, A.P., *See* Zenkevich, P.R., 15:49234
Koropov, A.V., Island structure growth and continuous film production criteria. 1. Weak atom sources, 15:48884 (R;UA;In Russian)
Island structure growth and continuous film production criteria. 2. Strong atom sources, 15:48885 (R;UA;In Russian)
Kot, W.K., *See* Poirot, I.S., 15:49020
Kotre, C.J., *See* Faulkner, K., 15:49663
Kouts, C.A., Optimizing spent fuel cask designs for use in the federal waste management system: Volume 1, 15:49174 (BA;US)
Kovac, R.J., *See* O'Neil, D.J., 15:48419
Kovalenko, V.G., *See* Gulyaev, V.A., 15:50136
Kovalenko, V.I., Study on the fracturing of cermets in the tungsten monocarbide-cobalt system during microimpact loading, 15:48926 (R;UA;In Russian)
Kovalev, S.V., *See* Arsen'ev, A.V., 15:50160
Kozak, V.R., Software for the ODRA and ODRENOK computers; programs for text file processing, 15:50220 (R;SU;In Russian)
Kozhamkulov, T.A., *See* Agasyan, N.O., 15:49976
Kozhurkin, G.N., *See* Veryutin, V.A., 15:49253
Kozlov, G.A., Decays of η- and K_L-mesons into a lepton pair: three-dimensional theory and phenomenology, 15:49951 (R;SU;In Russian)
Kozlov, V.P., *See* Bashmakov, V.S., 15:49228
Kozma, P., *See* D'yachenko, V.M., 15:49260
Kponou, A., *See* Alessi, J.G., 15:49239
Kraiman, J.B., Diffusion of muonic hydrogen atoms, 15:50189 (RA;GB)
Kralik, M., *See* Borisov, A.A., 15:50056
Kramer, H.M., Radiological properties of an automatic exposure control system: Tolerances, limiting values and appropriate measuring methods, 15:49671 (RA;GB)
Kramer, S., *See* Murphy, J.B., 15:49275
Kramer, S.J., *See* , 15:48947
See Lindquist, D.H., 15:48947
Kramers, P.G.N., *See* Montizaan, G.K., 15:49725
Krasheninnikov, S.I., *See* Dvornikova, N.A., 15:50128
Krasnokutskij, R.N., Spatial resolution of electromagnetic liquid krypton calorimeter: Monte-Carlo simulation, 15:49300 (R;SU;In Russian)
Krasnoshchekov, O.V., *See* Shvedov, O.V., 15:48627
Krause, F., Program experience and its regulatory implications: A case study of utility lighting efficiency programs, 15:48784 (R;US)
Krause, H.F., *See* Dittner, P.F., 15:49917
Krause, R.F., Fracture resistance behavior of silicon carbide whisker-reinforced alumina composites with different porosities, 15:48942 (J;US)
Krauss, A.R., Computer-controlled ion beam deposition systems for high T_c superconductor and other multi-component oxide thin films and layered structures, 15:48911 (R;US)
Kravtsov, A., *See* Gula, A., 15:50191
Kravtsov, V.D., *See* Akopyan, V.P., 15:49246
Kreienfeld, H., *See* Klimpel, H., 15:49670
Kreitzman, S.R., *See* Kadono, R., 15:50029
Kresin, V.Z., Major parameters of the high-T_c oxides, 15:49122 (RA;US)
Normal and superconducting properties of new high-T_c materials, 15:48965 (RA;US)
Origin of high T_c, 15:49121 (RA;US)
Proximity effect, 15:49210 (RA;US)
See Kihlstrom, K.E., 15:48889
See Thompson, R.S., 15:48930
Kretschmer, G., Global warming: Australian impacts and responses, 15:49449 (RA;US)
See Chiang, Shan-Hsin, 15:49436
Kreysa, E., *See* Tuffs, R.J., 15:49791
Krieger, S.J., *See* Bonche, P., 15:50013
Krier, H., *See* Peters, J.E., 15:48121
Kristen, F., *See* Haber, C., 15:49273
Krivtsun, I.V., *See* Gvozdetskij, V.S., 15:50151
Krmpotic, F., Double beta decay, neutrino physics, nuclear structure and isospin and spin-isospin symmetries, 15:49926 (R;BR)
Kroeger, P.G., Bounding core temperature transients for severe and rapid water ingress scenarios in modular high temperature gas-cooled reactors, 15:48638 (R;US)
Kroha, H., Limits on compositeness of quarks and leptons from e^+e^- annihilation, 15:49977 (R;DE)
Krol', V.A., *See* Gnatyk, B.I., 15:49813
Krukovskij, A.Yu., *See* Gasilov, V.A., 15:50124
Krupa, J.C., *See* Edelstein, N., 15:49019
Krupin, V.A., *See* Berezovskij, E.L., 15:50141
See Bugarya, V.I., 15:50140
Krutov, A.M., *See* Nosov, V.I., 15:48596
Krylov, A.R., *See* Timoshenko, G.N., 15:49261
Kryska, L., *See* Dvoracek, J., 15:50149
Kubas, G.J., *See* Van Der Sluys, L.S., 15:49092
Kubik, V.M., *See* Zlatanov, Z., 15:49950
Kubono, S., Nucleosynthesis in the rapid-proton process, 15:50004 (R;JP)
Kuchin, I.A., Possible change of growth regime for the total cross section of hadron processes at E_0 >or approx. 10^{15} eV, 15:49956 (R;SU;In Russian)
Kudo, Mitsuyoshi, *See* Suzuki, Masatoshi, 15:48631
Kudryavtsev, A.E., Analysis of the reaction p-barp→Λ-barΛ near the threshold, 15:49940 (R;SU)
Kuerster, M., *See* Vrtilek, S.D., 15:49837
Kukushkin, Yu.A., *See* Shvedov, O.V., 15:48627
Kulaga, A.E., *See* Arsen'ev, A.V., 15:50160
Kulhawy, F.H., *See* Stewart, H.E., 15:48674
Kulig, M., Thermohydraulic analysis for supporting PSA of SB LOCA in WWER-440: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48551 (RA;XA)
Kullberg, M.L., *See* Singh, J.P., 15:48916
Kulsrud, R.M., *See* Tajima, T., 15:49749
Kumagai, Tateo, *See* Konno, Masayuki, 15:49279
Kumamaru, Hiroshige, *See* Suzuki, Mitsuhiro, 15:48656
Kumar, A., *See* Heben, M.J., 15:48454
See Miskelly, G.M., 15:50108
Kumar, L, Outlook for demand growth in Asian countries, 15:48698 (RA;CA)
Kung, A.H., *See* Cromwell, E., 15:49140
See Tricki, T., 15:49886
Kunitomi, Kazuhiko, Safety demonstration test plan in the High Temperature Engineering Test Reactor (HTTR) and safety evaluation, 15:48655 (R;JP;In Japanese)
Kunth, D., *See* Mas-Hesse, J.M.M., 15:49802
Kuntner, M., *See* Kallinger, W., 15:49665
Kuo, T.T.S., *See* Gregoire, C., 15:50008
Kupriyanov, B.V., *See* Bashmakov, V.S., 15:49249
Kurchaninov, L.L., Fast-cycling minidrift chamber with freon-14 (80%) and isobutan (20%) mixture, 15:49299 (R;SU;In Russian)

Investigation of radiation stability of low-noise transistors, 15:49365 (R;SU;In Russian)
See Krasnokutskij, R.N., 15:49300
Kurita, Hiromi, *See* Sjarief, S.H., 15:49714
Kushnir, V.A., *See* Gusynin, V.P., 15:49967
Kuslap, P., *See* Pitkaenen, H., 15:49636
Kussmaul, K., Investigation of materials from decommissioned reactor pressure vessel - a contribution to the understanding of irradiation embrittlement: Summary report, 15:48605 (RA;XA)
Kuterbekov, K.A., *See* Yushkov, A.V., 15:49990
Kutty, P.V.E., *See* Kartha, P.K.S., 15:48222
Kutz, F.W., *See* McNelis, D.N., 15:49723
Kuznetsov, A.M., Ionic atmosphere effects on the energetics of thermal and optical electron-exchange reactions: Application to ferrocenium-ferrocene self exchange. Technical report, 15:49031 (R;US)
Kuznetsov, V.I., *See* Ovchinnikov, V.V., 15:48958
Kwon, J.H., *See* Williams, M.D., 15:48467
Kwong, Man Kam, *See* Garbey, M., 15:50215
Kyle, R., *See* Abbrecht, P.H., 15:49410
Kyritsis, S., The LEBEN - Project (Greece): Regional energy plan for Evrytania, 15:48727 (RA;LU)

L

La Count, D.F., *See* Russell, E.W., 15:48369
Labanan-Garcia, L.G., Combatting the greenhouse effect: Philippine style, 15:49446 (RA;US)
Labiosa, J., *See* Kinch, R., 15:49506, 15:49507, 15:49508, 15:49509, 15:49510
See Rosengrant, L., 15:49481, 15:49490, 15:49491, 15:49496
Labiosa, J.E., *See* Rosengrant, L., 15:49495
Laesene, A., *See* Pitkaenen, H., 15:49636
Laher, R.P., Updated excitation and ionization cross sections for electron impact on atomic oxygen. Quarterly report, 15:49891 (R;US)
Lala, J.R., *See* Smith, D.C., 15:48938
Laitano, R.F., *See* Pani, R., 15:49657
Lake, W.H., Investigation of burnup credit allowance in the criticality safety evaluation of spent fuel casks: Volume 1, 15:48382 (BA;US)
See Kouts, C.A., 15:49174
See Rashid, Y.R., 15:48387
See Thornhill, C.K., 15:48221
Lakervi, E., *See* Etula, H.J., 15:50236
Lam, D.J., *See* Chang, H.L.M., 15:48915
Lambard, J., *See* Zemb, T., 15:49284
Lambertson, G.R., *See* Jacob, A.F., 15:49236
Lamers, H.J.G.L.M., *See* Strous, L.H., 15:49790
Lamminen, J., Manufacture of air electrodes and long run tests, 15:48763 (R;FI)
Lampinen, M.J., *See* Lamminen, J., 15:48763
Lanagan, M.T., *See* Wu, J.L., 15:49205
Lancaster, G., *See* McWright, G., 15:49380
Lancet, M.S., *See* Winschel, R.A., 15:48076
Lande, K., Status of solar neutrino observations and prospects for future experiments: Volume 571, 15:49845 (BA;US)
Landis, D.A., *See* Goulding, F.S., 15:49339
See Hinshaw, S.M., 15:49335
See Llacer, J., 15:49341
See Madden, N.W., 15:49330
Landman, L.C., I/m test variability. Technical report, 15:48160 (R;US)
Landsfeld, M., *See* Karasaki, K., 15:48339
Lane, R.K., *See* Baxter, A.M., 15:48573
Lane, S., *See* Yorkey, T., 15:49652
Lang, H., Influence of humic acids on the solubility and sorption characteristics of inorganic cations as exemplified by Cs, Sr, Zr and Nb, 15:49596 (RA;DE;In German)
See Wolfrum, C., 15:49459
Langry, K.C., Vapor-phase measurements of volatile organochlorides using fiber optics, 15:49637 (BA;US)
Lardeau, J.P., *See* Brosseau, G., 15:48449
Larimer, F.W., *See* Brown, G.M., 15:49647
Larkin, R.J., *See* Page, R.H., 15:49135
Larwill, M., *See* Swoboda, C., 15:49336
Lashmore, D., *See* Majkrzak, C.F., 15:48857
Lasnier, F., *See* Ang, T.G., 15:48458
Last, G.V., Well network and measurement schedules for monitoring water-level changes beneath the separations area of the Hanford Site, 15:49741 (R;US)
Latorre, V.R., *See* Ramirez, A.L., 15:48332
Latyeva, L.A., *See* Fil, N.S., 15:48554
Lau, K.C, *See* Radhakrishna, H.S., 15:48678
Lau, S.S., *See* Xia, W., 15:48951
Laughlin, k.B., *See* Busarow, K.L., 15:49000
Laughlin, K.B., *See* Blake, G.A., 15:49048
See Busarow, K.L., 15:49136
See Cohen, R.C., 15:49047, 15:49139
Laul, J.C., Natural radionuclides in groundwater from J-13 well at the Nevada test site: Volume 1, 15:48310 (BA;US)
See Cole, D.R., 15:49739
Lautard, P., *See* Jacquemot, S., 15:50110
Lautzenhiser, T., *See* Ander, M.E., 15:50107
Laux, M., *See* Rainer, H.-D., 15:50148
Lawinski, C., *See* Fitzgerald, M., 15:49675
Lawrence, J., New Zealand's response to global climate change, 15:49450 (RA;US)
Lawson, L.O., Artificial intelligence in process control, 15:48110 (RA;US)
Layte, P., *See* Johnson, R.L., 15:48209
Lazaro, C., IR spectrophotometry of bright carbon stars: Proceedings of the 22. Eslab Symposium, 15:49785 (RA;FR)
Le Blanc, F., Laser spectroscopy of laser-desorbed gold isotopes, 15:50073 (R;FR)
Le, L.P., μ^+SR studies on $Sr_2CuO_2Cl_2$, La_2CuO_4, and Nd_2CuO_4: 2-d magnetism, local fields and muon sites, 15:48923 (R;US)
League, J., Bioremediation: Innovative applications of an established technology: Volume 1, 15:48164 (RA;CA)
Leahy, R., *See* Singh, M., 15:49363
Learner, R.C.M., *See* Spyromilio, J., 15:49789
Leask, L.E., *See* Hamley, P.T., 15:48149
LeBaron, B.A., Frequency profiles of residential wood burning for the northwestern United States, 15:48442 (R;US)
LeBeau, S.E., *See* Miller, T.A., 15:48922
Lebedev, A.I., *See* Egorov, O.K., 15:49304
Lebedev, N.N., Computer operating support system of NPP main equipment: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48613 (RA;XA)
Lebedev, S.G., Study on charge exchange and radiation resistance of carbon targets in the I-2 proton linear accelerator, 15:49257 (R;SU;In Russian)
Lebedev, V.N., *See* Golovachik, V.T., 15:49301
Lebedeva, G.S., *See* Lebedev, S.G., 15:49257
Leboeuf, J.N., *See* Ritz, C.P., 15:50112
Leclercq, C., *See* Barbier, J.P., 15:48456
Lee, C.W., *See* Smith, P.H., 15:49005
Lee, D.K., *See* Ritz, C.P., 15:50112
Lee, E.Y., *See* Haas, J.W. III, 15:49027
Lee, J.K.P., *See* Le Blanc, F., 15:50073
Lee, J.R., *See* Ball, A.H., 15:49331
Lee, K., *See* Ramirez, A.L., 15:48332
Lee, K.H., Application of geophysical methods for fracture characterization: Volume 1, 15:48331 (BA;US)
Lee, K.W., *See* Denning, R.S., 15:48663
Lee, Kien-Yin, Preparation and properties of 3-amino-5-nitro-1,2,4-triazole, 15:49392 (R;US)
Lee, M.K., *See* Garner, S.J., 15:48452
Lee, S.Y., The new conceptual design of snakes and spin rotators in RHIC, 15:49230 (R;US)
Lee, V.Y., *See* Burmester, C.P., 15:48932
Lee, W.W.L., *See* Hwang, Y., 15:48304
See Zwahlen, E.D., 15:48380
Lee, Y.T., Crossed molecular beams, 15:49050 (RA;US)
See Blake, G.A., 15:49048
See Busarow, K.L., 15:49000, 15:49136
See Cohen, R.C., 15:49047, 15:49139
See Continetti, R.E., 15:49137
See Cromwell, E., 15:49140

See Page, R.H., 15:49135
See Robinson, G.N., 15:49882, 15:49883, 15:49884
See Trickl, T., 15:49886
See Weiss, P.S., 15:49138, 15:49885
See Zhao, X., 15:49141
Leers, H.-D, *See* Napier, D.H., 15:48191
Lefebvre, F., Study of radiation effects on zircaloy 4 microstructure (Impact on susceptibility to fuel pellet-cladding interaction in PWR), 15:48873 (R;FR;In French)
Lefler, W., *See* Baxter, A.M., 15:48573
Leger, A., An almost total disjunction between emission and absorption dust features - what does it tell us: Proceedings of the 22. Eslab Symposium, 15:49766 (RA;FR)
See Verstraete, L., 15:49774
Leggett, S.A., Characterization of leachate produced from sulphur-contaminated soils: Volume 2, 15:48183 (RA;CA)
See England, S.L., 15:49585
Legros, J., Reduction of X-ray film processing variations: Tolerances, limiting values and appropriate measuring methods, 15:49685 (RA;GB)
Lehmann, J., CEQCSY: a new code for chemical equilibrium calculation in multiphased systems, 15:48273 (R;FR;In French)
Leitner, R., *See* Gorin, Yu.P., 15:49307
Leitz, W., Screening with mammography - what quality is required and how is it checked?: Tolerances, limiting values and appropriate measuring methods, 15:49676 (RA;GB)
Lellouch, E., *See* Encrenaz, Th., 15:49755
Lelong, V., *See* Proix, R., 15:48767
Lemeshewsky, W.A., *See* Vogel, L.W., 15:48328
Lemieux, R.R., Advanced vacuum pyrolysis project: State of the art and perspectives, 15:48421 (RA;LU)
Lemmel, H.D., Index of data libraries available on magnetic tape from the IAEA Nuclear Data Section, 15:50251 (R;XA)
Index to the IAEA-NDS-Documentation Series, 15:50250 (R;XA)
JENDL fission product nuclear data libraries: Contents and documentation, 15:49983 (R;XA)
See Manokhin, V.N., 15:49984
See Tuli, J.K., 15:49987
Leon, M., Interpretation of recent LAMPF results on dtμ formation, 15:50185 (RA;GB)
Leonard, M.T., *See* Denning, R.S., 15:48663
Leonova, S.V., *See* Korenman, G.Ya., 15:50190
Lequeux, J., *See* Jourdain de Muizon, M., 15:49784
Lerner, M., *See* Hagiwara, R., 15:48964, 15:49098
Lesage, R.P., *See* Arthur, J.E., 15:48196
Lesieur, P., *See* Zemb, T., 15:49284
Leskovar, B., Optical data transmission at the superconducting super collider, 15:49368 (J;US)
Lesnewski, M., *See* Veresczinski, Z., 15:50135
Lessard, G., *See* Massiera, M., 15:48451
Lester, M., Pi 2 pulsations and the substorm current wedge: Low-latitude polarization, 15:49857 (R;US)
Lester, W.A. Jr., Molecular interactions, 15:49145 (RA;US)
See Braga, M., 15:49046, 15:49881
See Hammond, B.L., 15:50233
See Sun, Z., 15:49880
Leu, H.J., *See* Singh, J.P., 15:48916
Leung, K.T., Adsorption and surface reactions of H_2S and SO_2 on Cu(100) studied by electron-energy-loss spectroscopy, 15:49134 (RA;US)
Surface bonding geometry of (2 x 1)S/Ge(001) by normal-emission angle-resolved photoemission extended fine structure, 15:48962 (RA;US)
See Terminello, L.J., 15:48963
Leung, W.Y., *See* Schmitz, P.J., 15:48878
Levi, M., *See* Kent, J., 15:49322
Levich, R.A., The international Stripa project: Technology transfer from cooperation in scientific and technological research on nuclear waste disposal: Volume 1, 15:48334 (BA;US)
Levin, M.V., *See* Ageev, A.I., 15:49181
Levy, A.V., A cold model study of wear on fluidized bed combustor tubes, 15:48890 (RA;US)
Materials for enhanced heavy fuel capability marine diesels, 15:48931 (RA;US)
Studies of materials erosion in coal conversion and utilization systems, 15:48117 (RA;US)
Levy, P.W., *See* Woody, C.L., 15:48940
Lewis, B.E., *See* Carnal, C.L., 15:48226
Lewis, N.S., *See* Heben, M.J., 15:48454
Lewis, S.J.L., Priority setting of strategies for limiting global warming, 15:49423 (RA;US)
Lewis, S.L., *See* Chung, F., 15:49431
Lewitowicz, M., *See* Bazin, D., 15:50003
Leyser, E., The economics of uranium recycling in the LWR fuel cycle: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988, 15:48246 (RA;XA)
Lezberg, E.A., *See* Brabbs, T.A., 15:49156
Leznov, A.N., On integrating of a singular integro-differential equation, 15:50096 (R;SU;In Russian)
Liao, J.J., *See* George, E.P., 15:48867
Liberman, S., *See* Le Blanc, F., 15:50073
Liddle, A.R., *See* Barrow, J.D., 15:49818
Lie, S.K., *See* Braga, M., 15:49881
Liepins, G.E., A unified framework for credit assignment, 15:50214 (R;US)
Lievens, F., *See* Pauwels, J., 15:48994
Lightfoot, P., Excess oxygen defects in layered cuprates, 15:48913 (R;US)
Ligotke, M.W., Soil erosion rates from mixed soil and gravel surfaces in a wind tunnel, 15:49584 (R;US)
Liikala, T.L., *See* Last, G.V., 15:49741
Liimatainen, K.-R., Development of an energy management system, 15:48831 (R;FI;In Finnish)
Likhoded, A.A., *See* Gershtejn, S.S., 15:49911
Likkel, L., *See* Omont, A., 15:49788
Liles, D.R., *See* Rider, W.J., 15:48577
Lima, J.A.S., On the thermodynamics of one-fluid Szekeres'like cosmologies, 15:49746 (R;BR)
Lin, H., *See* Ritz, C.P., 15:50112
Lin, R.P., *See* Parsons, A., 15:49345
Lin, S., *See* Mansfeld, F., 15:48855
Lin, S.Y., *See* Jones, E.D., 15:48975
Lin, W., *See* Ramirez, A.L., 15:48332
Lin, X, A study of Ontario Hydro's contribution to ozone levels in Ontario: Phase 1: Literature review, 15:48450 (R;CA)
Lindgren, O., Power generation using a low power Organic Rankine Cycle, 15:48492 (R;FI;In Finnish)
Lindle, D.W., Angle-resolved photoemission from the Ar 2p subshell, 15:49132 (RA;US)
See Medhurst, L.J., 15:49131
See Piancastelli, M.N., 15:49133
Lindquist, D.H., Formation and pore structure of boron nitride aerogels, 15:48947 (J;US)
Lindskoug, B.A., Quality assurance of computed tomography scanner beams in diagnostic radiology: Tolerances, limiting values and appropriate measuring methods, 15:49680 (RA;GB)
Linhares, M.P., EPR studies of photolysis of HbNO at low temperatures, 15:50067 (R;BR)
Link, H.F., *See* Bharathan, D., 15:48471
Link, R., *See* Chakrabarti, S., 15:49361
Linko, M., Non-waste technology - a challenge to biotechnology: Volume 1, 15:48827 (RA;FI)
Lioure, A., Interstellar gas cycling powered by star formation, 15:49747 (R;FR)
Lipartellani, A.G., *See* Amaglobeli, A.N., 15:49931
Lisak, M., *See* Anderson, D., 15:50113
Lissauer, D., *See* Debbe, R., 15:49323
See Fischer, J., 15:49267
Lister, D.H., The effect of dissolved zinc on the transport of corrosion products in PWRs: Final report, 15:48544 (R;US)
Little, R.C., *See* Forster, R.A., 15:49376
Liu Qiaosheng, Economics of low enriched uranium in China: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988, 15:48251 (RA;XA)
Liu, C., Magnetic properties of ultrathin epitaxial films of iron, 15:48861 (R;US)
Liu, C.T., *See* George, E.P., 15:48867
Liu, H.T., *See* Ho, C.M., 15:48805

Liu, M., Chemical stability of sodium beta''-alumina electrolyte in sulfur/sodium polysulfide melts, 15:49111 (RA;US)
Electrochemical investigations of organodisulfide/thiolate redox couples, 15:49113 (RA;US)
Liu, S.H., *See* Lindle, D.W., 15:49132
See Medhurst, L.J., 15:49131
See Piancastelli, M.N., 15:49133
Liu, Y.L., *See* Krauss, A.R., 15:48911
Livengood, C.D., Dry FGD [flue-gas desulfurization] at Argonne National Laboratory, 15:48500 (R;US)
See Doctor, R.D., 15:48071
Livingston, H., *See* Palmieri, J., 15:49610
Livnat, A., *See* Quan, C., 15:48384
Llacer, J., High dynamic range discriminator for measurements with fragmented heavy ions, 15:49341 (J;US)
See Veklerov, E., 15:49702
Lloyd, T.B., *See* Fowkes, F.M., 15:48085
Lobb, D, A study of the impact of no-till on tractor fuel cost vs crop returns, as affected by various no-till planter modifications, 15:48819 (R;CA)
Lobner, P., Overview and comparison of US commercial nuclear power plants: Nuclear power plant system sourcebook, 15:48539 (R;US)
Locat, J., Assessment of the organics containment plume at Ville-Mercier, Quebec, Canada: Proceedings, 15:49586 (RA;CA)
Lockyer, N., *See* Barsotti, E., 15:49274
Lodding, A.R., *See* Wicks, G.G., 15:48319
LoDestro, V., *See* Alessi, J.G., 15:49239
Loehman, R.E., Bonding mechanisms in silicon nitride brazing, 15:48943 (J;US)
Loffman, R.S., Quality Assurance (QA) plan for the Airlift Deployment Analysis System (ADANS), 15:49391 (R;US)
Logg, C.A., DEPOT: Database for electronics parts and other things, 15:49271 (J;US)
Lohnes, R.A., *See* Arnold, B.J., 15:48104
Loigu, E., *See* Pitkaenen, H., 15:49636
Long, S.A.T., *See* Kern, K.T., 15:48968
Long, S.E., Uranium and human diet: a literature review, 15:49710 (R;GB)
Longsine, D.E., *See* Gelbard, F., 15:48305
Longtin, A., Oscillation onset in neural delayed feedback, 15:49704 (R;US)
Longuemare, C., Study of neutrino oscillations in the frejus experiment, 15:49915 (R;FR)
Loo, J.A., *See* Smith, R.D., 15:49025
Loomis, B.A., Relationship of microstructure and tensile properties for neutron-irradiated vanadium alloys, 15:50167 (R;US)
Lorenzen, J., *See* Anderson, D., 15:50113
Lorenzetti, D., *See* Ceccarelli, C., 15:49781
Lottes, S.A., Effects of jet port arrangement on three-dimensional non-reacting jet -gas mixing in an MHD second stage combustor, 15:48106 (R;US)
See Chang, S.L., 15:48107
Lou, J.K., *See* Garner, S.J., 15:48452
Lou, K., *See* Petitjean, C., 15:50186, 15:50187
Loule, S.G., *See* Zhang, S.B., 15:50085
Louis-Jacquet, M., *See* Jacquemot, S., 15:50110
Loukas, D., *See* Dracos, M., 15:49287
Lours, T., *See* Craievich, A.F., 15:48909
Low, S.R., *See* Naus, D.J., 15:48608
Lowry, J., *See* Metz, W.C., 15:48344
Lowry, M., *See* McWright, G., 15:49380
Lu, A., *See* Cavalli-Sforza, M., 15:49359
Lu, P., *See* Jankowiak, R., 15:49646
Lubell, M.S., *See* Dalgarno, A., 15:49868
Lucchesi, A., Thermochemical conversion of biomass: A study on the pyrolysis of biomass, 15:48434 (RA;LU)
Ludemann, C.A., *See* Claytor, N., 15:49916
Ludlam, T., *See* Debbe, R., 15:49323
See Fischer, J., 15:49267
Lulk, K.O., *See* Dehli, M., 15:48829
Luke, B.A., Concepts in prototype testing for in situ geomechanical investigations at Yucca Mountain: Volume 1, 15:48333 (BA;US)
Luke, G.M., *See* Le, L.P., 15:48923
Lumpe, S.W., *See* Halbleib, L.L., 15:48977
Lusin, S., Upgrade of the AMY trigger system, 15:49315 (RA;JP)
Lutar, K., *See* Zemva, B., 15:49099
Luttrell, G.H., *See* Yoon, R.H., 15:48072
Lykasov, G.I., *See* Dolidze, M.G., 15:50038
Lyle, M.C., Geothermal ground-loop preinstallation project at Walden Pond: Final report, 15:48780 (R;US)
Lynch, V.E., *See* Ritz, C.P., 15:50112
Lyo, K., *See* Jones, E.D., 15:48975
Lyo, S.K., Light-heavy-hole-mixing-induced selection rules for magneto-luminescence and valence-band energy dispersion in semiconductor quantum wells, 15:49892 (R;US)
Lysne, P., Thermal neutron absorption cross sections for igneous rocks: Newberry Caldera, Oregon, 15:48479 (R;US)
Lysne, P.J., *See* Wemple, R.P., 15:49742
Lyttle, M.H., 1,5-disubstituted cyclooctatetraenes, 15:49062 (RA;US)
Lyubarskij, G.Ya., *See* Vorob'eva, V.P., 15:50179
Lyutostanskij, Yu.S., Strength function of xenon 127 and cross section of $^{127}I(\nu_e, e^-)^{127}Xe$ reaction, 15:50028 (R;SU;In Russian)

M

Ma, C.W., Deposition of airborne particles from fractured spent fuel or high-level waste: Volume 1, 15:48374 (BA;US)
Preclosure safety analysis for a prospective Yucca Mountain conceptual design repository: Volume 1, 15:48317 (BA;US)
Ma, Z., *See* Czok, M., 15:49026
Mabuchi, Kiyohiko, *See* Yoshimoto, Yasuhiko, 15:49717
MacAdam, S., Work in progress, 15:48891 (RA;US)
MacDonald, J.M., *See* Hamblin, D.M., 15:48771
Macedo, P.B., *See* Wicks, G.G., 15:48319
Machen, D.R., *See* Nelson, R.O., 15:50245
Machi, Suco, New trends in radiation processing application in Japan, 15:48406 (RA;JP)
Maclaren, V.W., Awareness and participation levels in high-rise apartment building recycling programs: Volume 2. Liquid and solid waste, analytical methods, environmental socio-economics, 15:48832 (RA;CA)
Madden, N.W., An improved operating mode for a Si(Li) x-ray spectrometer, 15:49330 (J;US)
See Llacer, J., 15:49341
Maddigan, R., *See* Hamblin, D.M., 15:48771
Maddox, S.R., *See* Bryan, W.L., 15:49561
Madeira, A.A., *See* Galetti, M.R.S., 15:48550
Madigozhin, D.T., Sensitivity of angular distribution of high energy muon flux from atmosphere to hadron charm production parameters: 1. High energy physics and computer technique, 15:49955 (RA;SU;In Russian)
Madore, C.M., On-site representation and oversight: A special role for the state of the Nevada and Nye County in the civilian radioactive waste management program: Volume 1, 15:48312 (BA;US)
Madsen, M.M., *See* Falci, F.P., 15:49171
Maerker, R.E., [Reactor dosimetry]: Foreign trip report, August 24, 1990–September 4, 1990, 15:48668 (R;US)
Maestas, E., *See* Chacey, K., 15:48326
Magazzu, A., Dust in planetary nebulae: IRSPEC observations in the 3.0 μm - 3.8 μm range: Proceedings of the 22. Eslab Symposium, 15:49786 (RA;FR)
Maggi, R., *See* Churin, E., 15:48425
Magruder, R.H., *See* Morgan, S.H., 15:48946
Maiano, P., *See* Del Guerra, A., 15:49353
Maidment, P.M., *See* Bruijn, T.J.W. de, 15:48195
Maillard, J.P., The environment of young stellar objects studied by high-resolution infrared spectroscopy: Proceedings of the 22. Eslab Symposium, 15:49768 (RA;FR)
Velocity-resolved spectra of BRα and BRγ on IRS16 SW and NE: Proceedings of the 22. Eslab Symposium, 15:49793 (RA;FR)
See Encrenaz, Th., 15:49755
Maiti, T.C., *See* Laul, J.C., 15:48310
Majanen, A., *See* Saeteri, J., 15:48796
Majeed, Q., *See* Wickramasinghe, N.C., 15:49758

Major, E.L., The application of vertical seismic profiling and cross-hole tomographic imaging for fracture characterization at Yucca Mountain: Volume 1, 15:48330 (BA;US)
See Lee, K.H., 15:48331
Majewski, S., *See* Hertzog, D.W., 15:49286
See Zorn, C., 15:49369
Majkrzak, C.F., Determination of hydrogen (deuterium) density profiles in thin metal films and multilayers by neutron reflection, 15:48857 (R;US)
Majland, O., *See* Oersted, H., 15:48828
Majors, P.D., *See* Bogush, G.H., 15:48973
Majsyukov, V.D., *See* Zaveryaev, V.S., 15:50144
Maki, N., Key technologies of superconducting generator, 15:49214 (R;JP)
Makkonen, S., *See* Liimatainen, K.-R., 15:48831
Makowiecki, D., *See* Debbe, R., 15:49323
See Fischer, J., 15:49267
Makri, N., Correct short-time propagator for Feynman path integration by power-series expansion in Δt, 15:50230 (RA;US)
Monte Carlo path integration for the real-time propagator, 15:50227 (RA;US)
Mal'tsev, I.G., Computer calculation of the powerful tube generator for accelerator HF power supply system, 15:49254 (R;SU;In Russian)
See Veryutin, V.A., 15:49253
Mal'tsev, M.V., *See* Glazov, V.M., 15:48856
Malhotra, R., *See* Hirschon, A.S., 15:48077
See Tingle, T.N., 15:48179
Malkan, M.A., *See* Spinoglio, L., 15:49807
Malley, J.P., *See* Kinner, N.E., 15:49633
Malofeev, V.M., TRECD program for three-dimensional calculation of a heterogeneous reactor in dipole approximation, 15:48597 (R;SU;In Russian)
Malone, R.G., *See* Batchelor, K., 15:49225
Maltby, J.D., MONT3E: A Monte Carlo electron heat transfer code, 15:50088 (R;US)
Mamczur, M., *See* Borowecki, M., 15:50142
See Sledzinski, S., 15:50139
Manabe, A., Data taking system for the FANCY, 15:50253 (RA;JP)
Mandzhos, A.V., *See* Verkhoglyadova, O.P., 15:49816
Manesse, D., The lessons drawn from accident simulation, consequences for the operation of the Crisis Technical Center of the Nuclear Safety and Protection Institut, 15:48639 (R;FR;In French)
Manfred, R.K., *See* Kettler, D.J., 15:48486
Mannik, L, Trip report: International Congress on Applications of Lasers and Electro-Optics, Oct. 16-19, 1989, Orlando, Florida, 15:48895 (R;CA)
Manokhin, V.N., ACTIV87 Fast neutron activation cross section file 1987, 15:49985 (R;XA)
BROND: USSR Evaluated Neutron Data Library, 15:49984 (R;XA)
Mansfeld, F., Corrosion protection of metal-matrix composites. Final report, October 1986-April 1990, 15:48855 (R;US)
Manson, S.T., *See* Lindle, D.W., 15:49132
Manthiram, A., *See* Lightfoot, P., 15:48913
Mantlik, F., *See* Hejna, J., 15:48584, 15:48585, 15:48586
Mao, N.H., *See* Ramirez, A.L., 15:48332
March-Leuba, J., *See* Damiano, B., 15:48527
See Ibn-Khayat, M., 15:48671
Marchenko, V.S., *See* Abarenov, A.V., 15:49875
Marchlenski, D., *See* Taddeucci, T.N., 15:50000
Marciano, L., *See* Raes, F., 15:48648
Marinin, V.G., *See* Kovalenko, V.I., 15:48926
Markovskij, D.V., FORTUN-88 physical module for calculation by Monte-Carlo method with microconstants on the estimated data file basis, 15:50054 (R;SU;In Russian)
Markuszewski, R., *See* Straszheim, W.E., 15:48087
Marrs, J.A., *See* Koehler, M.D., 15:48735
Marrs, R.E., Atomic physics of highly charged ions in an electron beam ion trap, 15:49895 (R;US)
Marshall, G.M., Emission of muonic hydrogen isotopes from solid hydrogen layers into vacuum, 15:50188 (RA;GB)
Marston, T., *See* Arlotto, G., 15:48522
Martens, H., Revegetation in the Canadian north. A 15 year perspective: Summary of findings: Volume 1, 15:48163 (RA;CA)
Martin, D.G, *See* Harding, J.H., 15:48872
Martin, S.J., *See* Frye, G.C., 15:49387
See Ricco, A.J., 15:49123
Martinez, D.Y.F., "In vitro" and "in vivo" studies 2,6 - diisopropylfenil-carboilmethyl iminodiacetic acid labeled with ^{99m}Tc (Disida -^{99m}Tc), 15:49713 (R;BR;In Portuguese)
Martinez, J.R., *See* Hawke, R.S., 15:49167
Martino, J., *See* Platchkov, S., 15:49904
Martins, M.N., *See* Dias, J.F., 15:50055
Martynov, S.A., *See* Vorob'eva, V.P., 15:50179
Martz, H., *See* Schneberk, D., 15:49318
Marumori, Toshio, *See* Sakata, Fumihiko, 15:50031
Maruyama, So, *See* Kunitomi, Kazuhiko, 15:48655
Marziani, M., *See* Gambaccini, M., 15:49677, 15:49678
Mas-Hesse, J.M.M., Evolutionary synthesis of the far-infrared emission in starburst galaxies: Proceedings of the 22. Eslab Symposium, 15:49802 (RA;FR)
Masaev, A.B., *See* Veryutin, V.A., 15:49253
Masaki, Nobuyuki, *See* Saeki, Masakatsu, 15:49149
Mascarenhas, Y.P., Refining of crystal structures of macromolecules with molecular dynamics, 15:49863 (RA;BR;In Portuguese)
Maschio, G., *See* Lucchesi, A., 15:48434
Maslen, L., First year results of revegetation trials using selected native plant species on a simulated pipeline trench, Fort Norman, N.W.T., Canada: Volume 1, 15:48162 (RA;CA)
Mason, A.A., Modeling and optimization of Li-alloy/metal-sulfide molten-salt batteries, 15:49117 (RA;US)
Mason, G.M., Distribution of a crystalline nickel (II) porphyrin in the Green River Formation, 15:48206 (R;US)
Massaro, T., The results and politics of oxygenated fuels in Colorado, 15:48844 (RA;CA)
Massarotti, A., Evolution of light domain walls interacting with dark matter, part 1, 15:49821 (R;US)
Massiera, M., Stress-strain behavior of the LG 4 dam: Proceedings, 15:48451 (RA;CA)
Masterov, V.S., *See* Badikov, S.A., 15:49999
Matalin-Slutskij, L.A., *See* Gulyaev, V.A., 15:50136
Mathews, M.A., *See* Hearst, J.R., 15:49401
Mathieson, E., Performance studies of a multiwire chamber, with 1 mm anode wire spacing, to be used for 2-D position-sensitive detection of x-rays, 15:49326 (J;US)
Mathys, L., *See* Cavalli-Sforza, M., 15:49359
Matson, B.S., *See* Olsen, K.B., 15:49638
Matsui, Tetsuo, *See* Yamamoto, Hisashi, 15:48917
Matsumoto, T., Development of high-Tc superconducting wire with high critical current density, 15:48935 (R;JP)
Matsuzaki, T., *See* Kadono, R., 15:50029
Matthijsen, A.J.C.M., *See* Slooff, W., 15:49724
Mattigod, S., *See* Schulze, D., 15:49565
Matzangou, X., *See* Schwarzenberger, P.M., 15:49212
Mauchien, P., *See* Autin, M., 15:48990
Mauderly, J.L., Influence of experimental pulmonary emphysema on toxicological effects from inhaled nitrogen dioxide and diesel exhaust. Research report, January 1984-September 1987, 15:49721 (R;US)
Maudlin, P.J., Implementation and assessment of the mechanical-threshold-stress model using the EPIC2 and PINON computer codes, 15:48886 (R;US)
Mauger, P.E., *See* Thomas, S., 15:49381
Mautz, W.J., Acid air pollutant mixtures: Respiratory system responses and effects of exercise, 15:49720 (R;US)
Mavko, B., *See* Gregoric, M., 15:48552
See Petelin, S., 15:48549
See Stritar, A., 15:48558
Maxon, B.S., Practical application of passive safety features for the advanced neutron source cooling system, 15:48642 (R;US)
Maxwell, G.M., *See* Pflum, D.L., 15:48115
May, E.N., *See* Celmaster, W., 15:49285
Maya, L., *See* Brown, G.M., 15:48936
Mayer, G.G., Advanced wastewater treatment, 15:48092 (RA;US)
Mayer, S.T., In situ laser Raman spectroscopy of copper anodization in alkaline media, 15:48694 (RA;US)
In situ scanning tunneling microscopy of Pb multilayer deposits on Ag, 15:48695 (RA;US)

Mayergoyz, I.D., Mathematical models of hysteresis: Progress report, January 1990–December 1990, 15:50091 (R;US)
Mayhew, W.J, *See* Thrall, R., 15:48782
Mazurov, E.V., *See* Veryutin, V.A., 15:49253
Mazurov, I.B., Study on the effect of main performance of Si-surface-barrier detectors of different area on the noise and timing parameters of a charged particle spectrometer, 15:49294 (R;SU;In Russian)
Study on the main performance of charged particle multichannel spectrometers at high input counting rates, 15:49295 (R;SU;In Russian)
Mazziotta, J.C., *See* Hoffman, E.J., 15:49701
McAtee, J.L., *See* Wolf, M.A., 15:49563
McAvey, V., *See* King, G.P., 15:48311
McCallum, J.C., *See* HcHargue, C.J., 15:48950
McCallum, R., *See* Probst, W., 15:48362
McCallum, R.W., *See* Finnemore, D.K., 15:48921
McCann, M.P., *See* Chen, C.H., 15:49206
McCarley, R.E., Synthesis and structure of phosphine, sulfide and amine adducts of the MO_6S_8 and W_6S_8 cluster units, molecular derivatives of Chevrel phase clusters and their tungsten analogues, 15:48937 (BA;US)
McCarty, J.G., *See* Tong, G.T., 15:48075
McClellan, G.C., *See* Imel, G.R., 15:48620
McClelland, J.B., *See* Taddeucci, T.N., 15:50000
McClelland, J.F., Transient infrared emission spectroscopy, 15:48996 (R;US)
McCollister, H.L., *See* Neilsen, M.K., 15:49217
McCorquodale, S.M, The ecology of elk in an arid environment: An overview of the Hanford elk project, 15:49640 (R;US)
McDonald, S., *See* Edmonds, J., 15:49420
McElhaney, S.A., A more rugged ZnS(Ag) alpha scintillation detector, 15:49564 (J;US)
See Chiles, M.M., 15:49364
McEvilly, T.V., *See* Lee, K.H., 15:48331
See Majer, E.L., 15:48330
McGhee, W.D., Synthesis of an (η^3-allyl)(hydrido)iridium complex and its reactions with arenes and alkanes. Sequential intermolecular C-H oxidative addition and hydride-to-alkene migratory insertion reactions, 15:49002 (RA;US)
McGrath, J.F., KMS Fusion Inc., 1989 semi-annual technical report, October 1988–March 1989, 15:50169 (R;US)
McGuinn, E.J., BR-100 spent fuel shipping cask development: Volume 1, 15:49172 (BA;US)
McHargue, C.J., Indentation testing of thin films and hard materials, 15:48912 (R;US)
McIntosh, D.L., High level radioactive waste management at the Savannah River Site: Volume 1, 15:48329 (BA;US)
McKay, R., *See* Gorbics, M.S., 15:49281
McKee, R.W., The coordination of system representation and operating assumptions for system studies in SIMS: Volume 1, 15:48358 (BA;US)
McKenzie, J., *See* Bullock, R.L., 15:48298
McKeon, D.C., *See* Soran, P.D., 15:49375
McKisson, J.E., *See* Haskins, P.S., 15:49362
McLain, H.A., *See* Hamblin, D.M., 15:48771
McLaughlin, K.L., *See* Bennett, T.J., 15:49403
McLaughlin, P.K., *See* Manokhin, V.N., 15:49984
McLean, J.C., NUHOMS modular spent-fuel storage system: Design, licensing and construction, 15:48233 (R;US)
McLeod, N.B., *See* Andress, D., 15:48366
McLuckey, S.A., *See* Glish, G.L., 15:49558
McManis, G.E., *See* Weaver, M.J., 15:49030
McMechan, G.A., *See* Ander, M.E., 15:50107
McMillen, D.F., *See* Hirschon, A.S., 15:48077
McNelis, D.N., Pilot study on international information exchange on dioxins and related compounds. Final report, 1985-1989, 15:49723 (R;BE)
McNutt, G.R., *See* Maxon, B.S., 15:48642
McRae, T., *See* Keddy, C.J., 15:48704
McSweeney, T., *See* Darrough, M., 15:48385
McVay, L., Application of video microscopy to in situ studies of electrodeposition, 15:48692 (RA;US)
McWright, G., Integrated optical modulators for analog signal transmission, 15:49380 (R;US)
Meadows, J.W., *See* Smith, D.L., 15:49980
Medelsohn, M.H., Strategies for utilizing ferrous*EDTA chelate as an additive in combined SO_2/NO_x aqueous scrubbing systems, 15:48499 (R;US)
Medhurst, L.J., Observation of correlation effects in zero kinetic energy electron spectra near the N1s and C1s thresholds in N_2, CO, C_6H_6, and C_2H_4, 15:49131 (RA;US)
See Lindle, D.W., 15:49132
See Piancastelli, M.N., 15:49133
Medina, E., Project LEBEN - Galicia (Spain): Energy exploitation of biomass, 15:48416 (RA;LU)
Mei, V.C., *See* Chen, F.C., 15:49161
Meier, D., Public involvement: Keystone to public confidence in the civilian radioactive waste management program: Volume 1, 15:48377 (BA;US)
Meijer, A., Yucca Mountain Project far-field sorption studies and data needs, 15:48284 (R;US)
Meikle, W.P.S., Infrared spectroscopy of supernova 1987A: Proceedings of the 22. Eslab Symposium, 15:49779 (RA;FR)
See Spyromilio, J., 15:49789
Meinken, G.E., *See* Dilmanian, F.A., 15:49346
Meiconian, J.O., Introducing the VRT gas turbine combustor, 15:49192 (R;US)
Melendres, C.A., Laser Raman spectroscopy "for in-situ" analysis of corrosion films on metals, 15:48866 (R;US)
Melnick, J., *See* Hunt, L., 15:49801
Melton, R.B., *See* Barga, R.S., 15:50239
Meltz, M.L., *See* Holahan, P.K., 15:49707
Mendes, R.S., *See* Gomes, M., 15:49965
Menezes, D.P., Selection of collective degrees of freedom in the boson space, 15:49964 (R;BR)
Merle, J.P., *See* Gouffon, A., 15:48543
Mermet, J.M., *See* Autin, M., 15:48990
Merrick, T., *See* Wong, M., 15:49270
Merrill, B.J., *See* Oh, C.H., 15:49154
Merrill, R.D., An investigation of the critical facility tritium monitoring, 15:48373 (R;US)
Mesmer, R.E., [Chemical thermodynamics]: Foreign trip report, August 23, 1990–September 5, 1990, 15:49082 (R;US)
Mestdagh, J.M., *See* Weiss, P.S., 15:49138, 15:49885
Metz, C.F. III, *See* Bradley, E.C., 15:48579
Metz, W.C., Hedonic price theory: Concept and applications: Volume 1, 15:48344 (BA;US)
Meunier, F., *See* Douss, N., 15:48781
Meyer, A., Canadian experience with renewable fuels, 15:48439 (RA;CA)
Meyer, B., *See* Galmiche, D., 15:50166
Meyer, B.S., *See* Howard, W.M., 15:49836
Meyer, J., *See* Bonche, P., 15:50013
Meyer, L.R., Seismic characterization of fracture properties: Volume 1, 15:48343 (BA;US)
Meyer, M., *See* Bonche, P., 15:50013
Meyer, T.J., *See* Worl, L.A., 15:49143
Meyer, W.T., *See* Gorbics, M.S., 15:49281
Meyers, J., Computation of emissions from exhaust-gas composition measurements, 15:48148 (R;US)
Meyers, M., *See* Meyers, J., 15:48148
Meyers, P., *See* Meyers, J., 15:48148
Meyers, T.P., *See* Sisterson, D.L., 15:49457
Michel, E., Study of photovoltaic sites in the Alpes-de-Haute-Provence, 15:48466 (R;FR;In French)
Michel, S., *See* Hooper, H.H., 15:49071
Michel, S.M., *See* Hooper, H.H., 15:49069
Michelotti, L., CANVAS: C++ objects for easy graphics on an Evans and Sutherland PS390 terminal: User's guide, 15:50216 (R;US)
Michels, L.R., Engineering study: Improved facilities for the removal of Iodine-131 from Purex process vent off-gas, 15:48225 (R;US)
Michlewicz, D., *See* Quan, C., 15:48384
Midgley, D., Analysis of PWR auxiliary coolant: determination of chloride in borax/nitrite solution by known addition - known dilution potentiometry, 15:48545 (R;GB)

Determination of boron as boric acid by automatic potentiometric titration using Gran plots [in pressurized water reactor coolant], 15:48993 (R;GB)
Mikhajlov, V.F., Observation of the Dirac magnetic charges by virtue of a diffusion chamber, 15:49909 (R;SU)
Mikhajlov, Yu.V., *See* Donskov, S.V., 15:49298
Mildener, M., *See* Kettler, D.J., 15:48486
Miley, G.H., CTR plasma engineering studies: Annual progress report, December 1, 1989–November 30, 1990, 15:50114 (R;US)
Millar, T.J., Chemistry on interstellar grains and implications for infrared spectroscopy: Proceedings of the 22. Eslab Symposium, 15:49762 (RA;FR)
Miller, D.L., The role of elf field dosimetry and bioeffects mechanisms in relating in vitro to in vivo exposures, 15:49730 (R;US)
Miller, D.W., *See* Bhatnagar, R., 15:48614
Miller, J.C., Resonance ionization spectroscopy of molecular clusters using picosecond lasers, 15:48992 (R;US)
Miller, L.L., *See* Le, L.P., 15:48923
Miller, M.J., *See* Lyttle, M.H., 15:49062
Miller, R., *See* Johnson, D., 15:49567
See Maxon, B.S., 15:48642
Miller, S.A., Laboratory particle-velocity experiments on rock from a USSR underground nuclear test site. Technical report, 15:49396 (R;US)
Miller, T.A., Microfilamentary $Bi_2Sr_2Ca_1Cu_2O_8$ fibers, 15:48922 (R;US)
Miller, W.H., A diabatic reaction-path Hamiltonian, 15:50229 (RA;US)
Effect of fluctuations in state-specific unimolecular rate constants on the pressure dependence of the average unimolecular reaction rate, 15:50228 (RA;US)
Theory of atomic and molecular collision processes, 15:50226 (RA;US)
See Makri, N., 15:50227, 15:50230
Miller, W.W., *See* Ball, A.H., 15:49331
Milligan, N.H, Operational testing of two thermal energy storge furnaces, 15:48689 (R;CA)
Millis, R.P., Processing of $YBA_2Cu_3O_7$ tapes from a molten salt precursor, 15:48924 (R;US)
Milner, C., *See* Ziock, H.J., 15:49374
Ming-Chin, Wu, *See* Shan-Hsin, Chiang, 15:49452
Minnucci, C., *See* Herhal, A.J., 15:48073
Miranskij, V.A., *See* Gusynin, V.P., 15:49967
Mirchandani, M.G., Task Order 2 enhanced preliminary assessment, Fort Douglas, Salt Lake City, Utah. Final report, October-December 1989, 15:49416 (R;US)
Miriam, J., *See* Zegers, P., 15:48807
Miro, J.E., *See* Austregesilo, H., 15:48533
Miroshnichenko, V.I., Forced scattering of a non-ordinary electromagnetic wave by an electron beam in a plasma in magnetic field, 15:50157 (R;UA;In Russian)
Mirskij, I.E., *See* Zaveryaev, V.S., 15:50144
Misak, J., Important conclusions from intermediate cold leg LOCA analysis of WWER 440 with RELAP4/MOD6 and SLAP: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48559 (RA;XA)
Mishima, J., Estimate of the source term for a repository surface facility from the routine processing of spent fuel: Volume 1, 15:48228 (BA;US)
Mishima, Kaichiro, Present status of research on boiling critical heat flux at low flow velocity, 15:49183 (RA;JP;In Japanese)
Miskelly, G.M., Analysis of the published calorimetric evidence for electrochemical fusion of deuterium in palladium. Technical report, 15:50108 (R;US)
Mitchell, A.W., *See* Dabrowski, B., 15:48910
Mitchell, G.F., *See* Maillard, J.P., 15:49768
Mitchell, J.T., *See* Debbe, R., 15:49323
See Fischer, J., 15:49267
Mitchell, N.G., *See* Coughtrey, P.J., 15:49711
Mitchell, R.R., Injector and valve train friction studies: Cummins L-10 engine: Progress report, October 1, 1988–December 31, 1989, 15:48836 (R;US)
Mitina, N.I., *See* Volkov, Ya.F., 15:50158
Mitra, S., [DNA repair and mutagenesis]: Foreign trip report, July 23, 1990–August 25, 1990, 15:49645 (R;US)
Miyazono, S., Research programs for LWR pressure boundary components in Japan: Summary report, 15:48535 (RA;XA)
Mizukami, Haruo, *See* Fukushima, Susumu, 15:48997
Mlynarczyk, A.Z, *See* Barber, D.H., 15:49605
Mo, *See* Cavalli-Sforza, M., 15:49359
Mochizuki, Tetsuro, Present status and subjects of ultrahigh neutron flux reactors in USA, 15:48632 (RA;JP;In Japanese)
Moens, P.B., Genetics and the unity of biology: Proceedings: Part 1 of 2, 15:49653 (R;CA)
Genetics and the unity of biology: Proceedings: Part 2 of 2, 15:49654 (R;CA)
Moeyaert, P., *See* Stubbe, E.J., 15:48556
Mohiudden, S., *See* Nieves, L.A., 15:48255
Moi, A., *See* Barbier, M.J., 15:48764
Molecke, M.A., *See* Wicks, G.G., 15:48319
Moles, M.D.C., *See* Piercy, R.J., 15:48235
Molle, J.F., Pyrolysis technology and products - Introduction, 15:48417 (RA;LU)
Mondino, M., Report on the interregional training course on implication of radiation induced embrittlement for the integrity of pressure vessels: Summary report, 15:48604 (RA;XA)
Moneti, A., Molecular hydrogen in the HII region G333.6-0.2: Proceedings of the 22. Eslab Symposium, 15:49769 (RA;FR)
Monroe, S.L., *See* Neilsen, M.K., 15:49217
Montemurro, P.A., *See* Alessi, J.G., 15:49239
Montizaan, G.K., Appendix to Report No. 758474011. Integrated criteria document PAH: Republication of Addendum to Report No. 758474007, March 1989. Effects of 10 selected compounds, 15:49725 (R;NL)
Integrated criteria document: Asbestos effects. Appendix, 15:49722 (R;NL)
See Slooff, W., 15:49724
Moore, C.B., Selective photochemistry, 15:49126 (RA;US)
See Berman, M.R., 15:49040
See Butenhoff, T.J., 15:49127
See Darwin, D.C., 15:49039
See Wasserman, P., 15:49003
Moore, E.F., *See* Khoo, T.L., 15:50011
Moore, T., *See* Puxley, P., 15:49806
Moores, B.M., Physical aspects of establishing tolerances and limiting values in diagnostic radiology: Tolerances, limiting values and appropriate measuring methods, 15:49659 (RA;GB)
Moorhead, A.J., *See* Kim, H.E., 15:48941, 15:48944
Moorwood, A.F.M., Infrared [FEII], H and H_2 lines in galaxy nuclei: Proceedings of the 22. Eslab Symposium, 15:49803 (RA;FR)
Near infrared spectroscopy of active galaxies: Proceedings of the 22. Eslab Symposium, 15:49794 (RA;FR)
See Moneti, A., 15:49769
See Oliva, E., 15:49770, 15:49787
Morawitz, H., *See* Kresin, V.Z., 15:49121
Morehouse, T.A., *See* Hamley, P.T., 15:48149
Moretto, L.G., Complex fragment emission in binary and multifragment decay of very hot nuclear systems, 15:50001 (R;US)
Morey, M., *See* Metz, W.C., 15:48344
Morgan, D., Amplitude analysis of $\gamma\gamma \rightarrow \pi\pi$ from threshold to 1.4 GeV, 15:49957 (R;GB)
Morgan, H.S., Thermal stresses in layered electrical assemblies bonded with solder, 15:49218 (R;US)
Morgan, J., *See* Gustafson, P., 15:49440
Morgan, J.R., Coping with sea level rise, 15:49439 (RA;US)
Morgan, S.H., Raman spectra of molybdenum phosphate glasses and some crystalline analogues, 15:48946 (J;US)
Morillon, C., *See* Pilot, G., 15:48279
Moroz, V.I., *See* Ierusalimov, A.P., 15:50035
Morozov, A.A., *See* Derevshchikov, A.A., 15:49296
Morris, D.E., *See* Strittmatter, R.J., 15:49028
Morris, J., *See* Arya, R.R., 15:48462
Morrison, H.D., Method of measuring Cf_3T activity developed for laser-based tritium separation, 15:48399 (R;CA)
Third isotope separation workshop, 15:48400 (R;CA)
Morrison, H.F., *See* Lee, K.H., 15:48331
Morsell, J.W., *See* Hamley, P.T., 15:48149
Mortazavi, P., *See* Murphy, J.B., 15:49275

Mortimer, W.P, Prediction of the environmental fate of pentachlorophenol as a function of pH using fugacity models, 15:49573 (R;CA)
Moseley, S.H., *See* Omont, A., 15:49788
Moser, H., *See* Wolf, M., 15:49598
Moser, T., *See* Steringer, A., 15:48277
Moser, W., *See* Zorn, C., 15:49369
Moses, W.W., Lead carbonate: A new fast, heavy scintillator, 15:49321 (J;US)
Mostafa, A.A., *See* Melconian, J.O., 15:49192
Mountain, M., *See* Puxley, P., 15:49805, 15:49806
Movsesyan, S.N., *See* Kazaryan, S.P., 15:49290
Moyer, B.A., Sticky molecules in nonpolar solvents: Importance of hydrogen bonding in the hydration and aggregation of polar molecules, 15:49088 (BA;US)
Mrugala, M., Rock mechanics aspects of the ESF design: Volume 1, 15:48301 (BA;US)
Mueller, A.C., Experiments on neutron-rich light nuclei at Ganil, 15:49995 (R;FR)
See Bazin, D., 15:50003
Mueller, R., *See* Birkigt, W., 15:48401
Mueller-Kahle, E., Uranium resources and supply-demand projections: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988, 15:48244 (RA;XA)
Muenzenberg, G., *See* Gaimard, J.J., 15:50006
Mukai, Masayuki, *See* Ogawa, Hiromichi, 15:49572
Mukha, I.G., Optimization of kinematically complete experiments in four-particle nuclear reactions by simulation method, 15:50027 (R;SU;In Russian)
Mukherjee, A., *See* Ramanujam, A., 15:48223
Mulcey, P., *See* Collinet, J., 15:48540
Mullen, E.G., *See* Gussenhoven, M.S., 15:49852
Muller, R.H., Surface layers on battery materials, 15:48693 (RA;US)
See Crocker, R.W., 15:48696
See Mayer, S.T., 15:48694, 15:48695
See McVay, L., 15:48692
Muller, W.F.J., *See* Bieser, F., 15:49338
Munro, J., *See* King, G.P., 15:48311
Munson, D.E., Data quality assurance controls through the WIPP in situ data acquisition, analysis and management system: Volume 1, 15:48368 (BA;US)
Mur, V.D., Quantization with acount of barrier permeability, 15:50098 (R;SU;In Russian)
Murakami, H., *See* Le, L.P., 15:48923
Muraleedharan, T.S., *See* Shaikh, A.N., 15:50062
Muramoto, E., *See* Martinez, D.Y.F., 15:49713
Murao, Yoshio, Present status and subjects of research on heat removal in high conversion light water reactors, 15:48570 (RA;JP;In Japanese)
See Okubo, Tsutomu, 15:48657
Murata, Hideo, *See* Suzuki, Mitsuhiro, 15:48656
Murphy, B.W., *See* Hutchins, G.D., 15:49349
Murphy, G.V., LQG/LTR control system design for a low-pressure feedwater heater train with time delay, 15:48612 (R;US)
Murphy, J.B., The Brookhaven Superconducting X-Ray Lithography Source (SXLS), 15:49275 (R;US)
Murphy, J.R., *See* Bennett, T.J., 15:49403
Murphy, M.J., Description of a PC-based coupled "PER" theory/finite element method for calculating shaped charge jet characteristics, 15:49394 (R;US)
Murphy, R.W., *See* Chen, F.C., 15:49161
See Ho, C.M., 15:48805
Murray, J.R., *See* Klein, V.F., 15:49367
Murray, P.E., Residual stress at fluid interfaces, 15:48870 (R;US)
Murty, V.S., Generic quality assurance/quality control guide for photovoltaic concentrator design, development and system installation, 15:48460 (R;US)
Muse, W.T., Wear-metal analysis in engine oil by microwave digestion and atomic absorption spectroscopy. Final report, August 1987-January 1988, 15:48988 (R;US)
Mustafin, Kh.Kh., *See* Abramov, A.G., 15:49256
Myalitsyn, V.K., *See* Kurchaninov, L.L., 15:49299
Myalton, T.B., *See* Bugarya, V.I., 15:50140
Myers, D.R., *See* Jones, E.D., 15:48976
Mysenkov, A.I., *See* Sarbukov, V.V., 15:48595
Myshinskij, G.V., Gas laser spectrometer for nuclear investigation at nucleonic stability limit. (project), 15:49308 (R;SU;In Russian)

N

Nabielek, H., *See* Kirch, N., 15:48634
Nagaev, V.I., *See* Mal'tsev, I.G., 15:49254
See Veryutin, V.A., 15:49253
Nagame, Yuichiro, *See* Ikezoe, Hiroshi, 15:49259
Nagamiya, Shoji, Towards high-density matter with relativistic heavy-ion collisions, 15:50030 (R;JP)
Nagar, M.S., *See* Ruikar, P.B., 15:48989
Naik, R.C., *See* Edelstein, N., 15:49019
Nair, B.R., Certification challenges in the development of an innovative high payload capacity spent fuel transportation cask: Volume 1, 15:49170 (BA;US)
Najzer, M., Review of research activities in the area of reliability of reactor pressure components in Yugoslavia: Summary report, 15:48566 (RA;XA)
See Glumac, B., 15:48567
Nakada, Y., *See* Sellgren, K., 15:49773
Nakahara, J.F., A study of the thermoelectric properties of Ca, Sr and Hg substituted lanthanum sulfides, 15:48956 (R;US)
Nakai, N., *See* Puxley, P., 15:49806
Nakajima, Hajime, *See* Watanabe, Katsutoshi, 15:48882
Nakajima, T., *See* Hagiwara, R., 15:49098
Nakamura, Hideo, *See* Suzuki, Mitsuhiro, 15:48656
Nakamura, Takehiko, Estimation of energy deposition in various test fuels in the NSRR FBR fuel tests, 15:48583 (R;JP;In Japanese)
Nakashima, Mikio, *See* Saeki, Masakatsu, 15:49149
Nakhla, G.F., *See* Suidan, M.T., 15:48093
Nambi, K.S.V., *See* Basu, A.S., 15:50061
Nancarrow, D., *See* Unsworth, M.D., 15:48265
Napier, D.H., Propane storage. Report on hazard and risk assessment of propane storage on garage forecourts, 15:48191 (R;CA)
Narisi, Hideki, Present status of research on boiling critical heat flux in narrow channel, 15:49184 (RA;JP;In Japanese)
Naruta, C.K., *See* Lindquist, D.H., 15:48947
Nashimoto, M., Current status of forest decline and its research activities in Europe, 15:48702 (R;JP;In Japanese)
Nasreen, G., *See* Lindle, D.W., 15:49132
Natesan, K., Corrosion behavior of materials in FBC [fluidized-bed combustion] environments, 15:48105 (R;US)
Nathanson, G.A., *See* Robinson, G.N., 15:49884
Naus, D.J., Crack-arrest behavior in SEN wide plates of low-upper-shelf base metal tested under nonisothermal conditions: WP-2 series, 15:48608 (R;US)
See Oland, C.B., 15:48646
Navarro, H., Study of the fundamental linewidths of 1S → nP donor transitions in ultrapure germanium, 15:48966 (RA;US)
Navelet, H., *See* Calan, C. de, 15:49922
Nazirov, M.T., *See* Ivkin, A.V., 15:49954
Nealy, J.E., *See* Wilson, J.W., 15:49716
Nedzelski, V., *See* Borowecki, M., 15:50142
See Sledzinski, S., 15:50139
Neel, J.V., *See* Yoshimoto, Yasuhiko, 15:49717
Negishi, T., Biological effects of combined exposure to coal fly ash and nitrogen dioxide. 3.: Morphological changes in respiratory organs of golden hamster, 15:48122 (R;JP;In Japanese)
Nelsen, M.K., Development of hermetic microminiature connectors, 15:49217 (R;US)
Nekrasov, M.L., On mixing of states in relativistic-invariant theory, 15:49937 (R;SU;In Russian)
Nelson, R.O., The single-chip FASTBUS slave interface, 15:50245 (J;US)
Nelson, T.A., *See* Russell, E.W., 15:48369
Nerushev, S.B., On POLEX experiment at UNK, 15:49278 (R;SU;In Russian)
Nesterenko, V.O., The multiphonon version of the quasiparticle-phonon nuclear model: application to the problem of existence of low-lying two-phonon states in deformed nuclei, 15:50039 (R;SU)
Nesterov, A.V., *See* Ostashko, V.V., 15:50034

Nesti, F., *See* Denby, B., 15:49269
Neuer, G., *See* Pflugfelder, G., 15:48874
Neumann, D.A., *See* Majkrzak, C.F., 15:48857
Newcomer, F.M., *See* Kononenko, W., 15:49358
Newman, D.A., On the way to ligating oligocyclopentadienyls: Synthesis and preliminary reactivity of the two isomeric tercyclopentadienyls and their transition-metal complexes, 15:49053 (RA;US)
Newman, J., Analysis and simulation of electrochemical systems, 15:49115 (RA;US)
See Hauser, A.K., 15:49120
See Risch, T., 15:49119
See Tribollet, B., 15:49118
See West, A.C., 15:49116
Newport, D.F., Integrating and enhancing tool for ASIC design using MOSIS fabrication, 15:49222 (J;US)
Newton, D., Retention of alkaline earth elements in man: Final report for the period 1 April 1986 - 14 May 1989, 15:49712 (R;XA)
Newton, J., *See* Arya, R.R., 15:48462
Nexsen, W.E., Characterization of field errors of layer wound short solenoids, 15:49266 (R;US)
Ney, J., *See* Manesse, D., 15:48639
Neyman, M., *See* Cook, W.J., 15:48503, 15:48504, 15:48505, 15:48506, 15:48507, 15:48508, 15:48509, 15:48510, 15:48511
Neymotin, L.Y., *See* Rohatgi, U.S., 15:48664
Nguyen, H.L., *See* Melconian, J.O., 15:49192
Nguyen, Son N., The solubility and free energy of formation at 30°C of dehydrated schoepite, $UO_3 \cdot 0.9H_2O$, 15:49560 (BA;US)
Nicholls, N., Global warming, tropical cyclones and ENSO [El Nino - Southern Oscillation], 15:49421 (RA;US)
See Edmonds, J., 15:49424
Nichols, L.L., *See* Brown, R.C., 15:49557
Nichols, R., Vehicle research for future fuels, 15:48843 (RA;CA)
Nickell, R.E., *See* Abbott, D.G., 15:48383
Niedzielski-Eichner, P.A, *See* Meier, D., 15:48377
Nieto, M.M., *See* Ander, M.E., 15:50107
Nieves, L.A., Identification and estimation of socioeconomic impacts resulting from perceived risks and changing images: An annotated bibliography, 15:48255 (R;US)
Nikolaeva, R.M., Microscopic description of neutron and proton transition moments in spherical nuclei: Collection, 15:50037 (RA;SU)
Nikolajchuk, L.I., *See* Zabela, A.G., 15:49235
Nikonov, Eh.G., *See* Zhidkov, E.P., 15:50101
Nikolaev, M.N., *See* Blokhin, A.I., 15:50009
Nima, Shuji, Scattering amplitude of string on orbifold, 15:49973 (RA;JP;In Japanese)
Nishimura, I., *See* Negishi, T., 15:48122
Nishino, T., Field-effect superconducting transistor, 15:49215 (R;JP)
Nishioka, Shuzo, The Japanese response to global warming - background, policy and research work, 15:49444 (RA;US)
See Edmonds, J., 15:49424
Njo, D.H., Research activities in materials assessment, selection and development, fracture mechanics and non-destructive testing in Switzerland: Summary report, 15:48523 (RA;XA)
Noblett, J.G., Flue gas desulfurization (FGD) chemistry and analytical methods handbook: Volume 1, Process chemistry - Sampling, measurement, laboratory and process performance guidelines (Revision 1): Final report, 15:48514 (R;US)
Nolan, S.P., *See* Stoutland, P.O., 15:49057
Nomura, Toru, *See* Komori, Fumio, 15:50072
Norberg, R.E., Structure of amorphous-silicon and germanium alloy films: Annual subcontract report, January 15, 1989–January 14, 1990, 15:48463 (R;US)
See Baker, D.B., 15:50076
Norby, R.J., Nitrate reductase is induced in red spruce by NO_2 and HNO_3 vapor, 15:49726 (J;US)
Norcross, W.R., *See* Kettler, D.J., 15:48486
Nordh, H.L., Wide-beam balloon observations of the 157.7 μm [CII]-line: Proceedings of the 22. Eslab Symposium, 15:49767 (RA;FR)
Norkin, D.T., *See* Ball, A.H., 15:49331
Norseev, Yu.V., Introduction of astatine into monoclonal antibodies, 15:49150 (R;SU;In Russian)
Nosov, V.I., Analysis of inhomogeneities of reactor fuel assemblies using statistics criteria, 15:48596 (R;SU;In Russian)
Notin, C., Putting into service the RFO wind turbine at the CNEEL, 15:48481 (R;FR;In French)
Notkin, G.E., Technological start of T-15 tokamak. The start-up diagnostic complex, 15:50134 (RA;CS;In Russian)
Notz, K.J., Characteristics of potential repository wastes: Volume 1, 15:48361 (BA;US)
Novello, M., Does there exist a gravitational analogue of the electroweak unification, 15:49919 (R;BR)
Novikov, V.E., *See* Bolotov, V.N., 15:49879
Novinski, J., *See* Kauffman, J.M., 15:49204
Nowak, D., A microprocessor based charge control system for the simultaneous charging of several batteries with one charge controller: Final report for 1989, 15:48839 (R;US)
Nozaki, Tadao, Tracking, 15:49312 (RA;JP;In Japanese)
Nunn, P.D., Effects of global warming on South Pacific Islands, 1900-2100, 15:49442 (RA;US)
Nwokolo, B.N., Redesigning local transportation service for improved suburban mobility: The problem of accessibility for the elderly and low-income residents. Final report, 1 January 1989-31 May 1990, 15:48803 (R;US)
Nyman, D.H., *See* Smith, R.A., 15:48340

O

O'Brien, E., *See* Debbe, R., 15:49323
See Fischer, J., 15:49267
O'Brien, K.J., Stochastic electron beams in the ion-focused regime, 15:49893 (R;US)
O'Connell, W.J., Status of integrated performance assessment of the waste packages and engineering barrier system: Volume 1, 15:48316 (BA;US)
O'Neal, J.E., *See* Sastry, S.M., 15:48903
O'Neil, D.J., Advanced biomass pyrolysis technology in the US, 15:48419 (RA;LU)
O'Reilly, M.A, *See* Reinsch, A.E., 15:48139
O'Reilly, M.A., *See* Reinsch, A.E., 15:48141
O'Sullivan, R., *See* Kettler, D.J., 15:48486
Oba, K., *See* Dilmanian, F.A., 15:49346
Obert, J., *See* Le Blanc, F., 15:50073
Obot, N.T., Experimental and theoretical studies of friction and heat transfer in rough passages: Progress report, April 15, 1990–July 31, 1990, 15:49179 (R;US)
Obrebski, S., *See* Hedgpeth, J.W., 15:49593
Oda, Ichiro, Topological quantum field theories in higher dimensions, 15:49974 (RA;JP)
Oellinger, R., The role of CT In follow-up treatment of patients after proctectomy due to a carcinoma: A retrospective study of 93 patients, 15:49691 (R;DE;In German)
Oersted, H., Vester Nebel combined collective heat supply system: Demonstration project: Final report, 15:48828 (R;LU)
Oganesyan, Yu.Ts., Neutron-rich isotopes of the lightest elements, 15:49991 (R;SU)
Ogawa, Hiromichi, Evaluation of water flow velocity, dispersion length and retardation factor in radionuclide migration test using undisturbed samples of aerated sandy soil layer, 15:49572 (R;JP;In Japanese)
Ogawa, M.Y., Long range electron-transfer beyond 20Å across rigid polypeptide bridges, 15:49648 (BA;US)
Ogloblin, A.A., Detection of the radioactive decay of ^{236}Pu involving the emission of ^{28}Mg nuclei: Collection, 15:50017 (RA;SU;In Russian)
Ogul'chanskij, Ya.Yu., Statistical characteristics of turbulence in giant molecular clouds. Part 2: 2. Clump properties, 15:49815 (R;UA)
Ogul'chansky, Ya.Yu., Statistical characteristics of turbulence in giant molecular clouds. Part 1: 1. Spectra in inertial range, 15:49814 (R;UA)
Oh, C.H., Three-dimensional fluid flow in JFTOT [Jet Fuel Thermal Oxidation Tester], 15:49154 (R;US)
Ohly, W., *See* Wood, D.S., 15:48871
Ohnuki, Akira, *See* Okubo, Tsutomu, 15:48657
Ohnuki, Toshihiko, *See* Ogawa, Hiromichi, 15:49572
Ohsawa, Y., Conditions for ion reflection in a large-amplitude magnetosonic wave, 15:50165 (R;JP)

High-energy protons produced by a large-amplitude magnetosonic wave and associated gamma radiation through neutral pion decay, 15:49825 (R;JP)
Ohyabu, N., An empirical scaling of the thermal diffusivity applicable to both L- and H-mode discharges, 15:50164 (R;JP)
Okamoto, Futoshi, *See* Sawa, Kazuhiro, 15:48630
Okonov, Eh.O., Search for strangeness-abundant quark-gluon matter in nucleus-nucleus and antiproton-nucleus interactions, 15:50042 (R;SU;In Russian)
Okot-Uma, R.W'O., African energy programme, a perspective of a regional project network, 15:48756 (R;GB)
Okubo, Tsutomu, Evaluation report on SCTF Core-III Test S3-20: Investigation of water break-through and core cooling behaviors under intermittent ECC water delivery to upper plenum during reflood phase in PWRs with combined-injection type ECCS, 15:48657 (R;JP)
Ol'shevskij, A.G., *See* Gorin, Yu.P., 15:49307
Olague, N.E., *See* Gelbard, F., 15:48305
Oland, C.B., Development of the Structural Materials Information Center, 15:48646 (R;US)
Oliva, E., Near infrared (1 - 4 μm) spectroscopy of SN1987 A: Proceedings of the 22. Eslab Symposium, 15:49787 (RA;FR)
Near infrared spectroscopy of the supernova remnant RCW103: Proceedings of the 22. Eslab Symposium, 15:49770 (RA;FR)
See Moorwood, A.F.M., 15:49803
Oliver, W.L., Neutral and ion composition changes in the F Region over Millstone Hill during the equinox transition study, 15:49856 (R;US)
Olofsson, S.G., *See* Nordh, H.L., 15:49767
Olsen, A.R., *See* Sisterson, D.L., 15:49457
Olsen, K.B., Fiber optic spectrochemical emission sensor: A detector for chlorinated and fluorinated compounds, 15:49638 (BA;US)
Olsen, T., *See* Tangler, J., 15:48484
Olson, C.L., Intense ion beam transport in neutral gas, 15:50202 (R;US)
Olson, K.M., *See* Mishima, J., 15:48228
Omata, Kazuo, KODAQ (Kakuken On-line Data Acquisition System) based on PC-9801 personal computer, 15:50218 (R;JP;In Japanese)
Omont, A., Observations of 40-70 μm bands of ice in IRAS 09371+1212 and other stars: Proceedings of the 22. Eslab Symposium, 15:49788 (RA;FR)
Oms, J., *See* Le Blanc, F., 15:50073
Omura, N., *See* Kimura, K., 15:48074
Onogawa, Kazunobu, Global climate change and activities of UNEP [United Nations Environment Programme], 15:49425 (RA;US)
See Chung, F., 15:49431
Orlinskij, D.V., Some problems of plasma diagnostics in an experimental thermonuclear reactor, 15:50145 (RA;CS;In Russian)
Orlowski, S., Objectives, standards and criteria for radioactive waste disposal in the European Community: Euradwaste series No 1 Report of a working group on Joint elaboration of radioactive waste-management policies, 15:48281 (R;FR)
Orofino, V., *See* Colangeli, L., 15:49754
Ortega, R., *See* Villanueva, C., 15:48248
Oshio, K., *See* Singh, M., 15:49363
Osredkar, M., *See* Petelin, S., 15:48549
Ostashko, V.V., Comparison of theoretical and phenomenological phase shifts for $^{3}He(\alpha,\alpha)^{3}He$ scattering at ^{7}Be excitation range between 25 and 42 MeV, 15:50034 (R;UA)
Ostenson, J.E., *See* Finnemore, D.K., 15:48921
Ostrovskij, A.O., *See* Balakirev, V.A., 15:50159
Otarov, A.R., *See* Karabekov, I.P., 15:49247
Otomura, K., *See* Yasuda, I., 15:48245
Ovchinnikov, V.V., Controllable changes in the porous structure of polymeric nuclear membranes, 15:48958 (R;SU)
Overbeck, R., *See* Klimpel, H., 15:49670
Overton, W.C. Jr., Superconductor imaging surface magnetometry: Principles and applications, 15:49385 (R;US)
Ovsepyan, G.G., *See* Avakyan, V.V., 15:49288
Owen, R.K., *See* Sun, Z., 15:49880
Owocki, S.P., *See* Poe, C.H., 15:49847
Ozaki, Hitoshi, A study on CP violation, 15:49961 (RA;JP;In Japanese)
Ozernoy, L.M., Primeval and rejuvenated galaxies: A new approach to the search for them: Volume 571, 15:49839 (BA;US)

P

Pachauri, R.K., Global warming: Perspectives on India's energy policies and responses to climate change, 15:49443 (RA;US)
Padilha, A.F., *See* Borges, J.F.A., 15:48875
Padilla, L.A., *See* Contreras, R., 15:49032
Paduch, M., *See* Veresczinski, Z., 15:50135
Paffett, M.T., *See* Van Der Sluys, W.G., 15:48219
Pafford, D.J., *See* Kelly, D.L., 15:48667
Page, R.H., High-resolution photoionization spectrum of water molecules in a supersonic beam, 15:49135 (RA;US)
Pagni, R.M., *See* Zingg, S.P., 15:49144
Pailliere, P., Classical treatment of the Compton collision in general relativity, 15:49923 (R;FR)
Paine, R.T., *See* Lindquist, D.H., 15:48947
Paintal, A.S., Final treatment standards for K069 nonwaste waters in the calcium sulfate/sodium subcategory and waste-water forms of K069. Volume 11. Memorandum report, 15:49485 (R;US)
Final treatment standards for nonwaste-water and waste-water forms of K100. Volume 12. Memorandum report, 15:49486 (R;US)
Pakdel, H., *See* Lemieux, R.R., 15:48421
Palbrica, R., *See* Quan, C., 15:48384
Palmer, D.D., *See* Buck, O., 15:48877
Palmer, D.W., *See* Sweet, J.N., 15:49191
Palmer, E.P., *See* Jones, S.E., 15:50200
Palmer, R.B., *See* Batchelor, K., 15:49225
Palmieri, J., US Mussel Watch Program: Transuranic element data from Woods Hole Oceanographic Institution 1976-1983. Technical report, 15:49610 (R;US)
Panchenko, V.N., *See* Lebedev, S.G., 15:49257
Pang, T., *See* Anderson, D.M., 15:49063
Pani, R., The use of a silicon surface barrier detector for quality assurance in diagnostic radiology: Tolerances, limiting values and appropriate measuring methods, 15:49657 (RA;GB)
Panin, V.M., *See* Ionov, A.I., 15:48574
Papouchado, L.M., *See* McIntosh, D.L., 15:48329
Papoular, R., A coal model for the carriers of the unidentified IR bands: Proceedings of the 22. Eslab Symposium, 15:49771 (RA;FR)
Pappert, S.A., *See* Xia, W., 15:48951
Paprocki, K., *See* Veresczinski, Z., 15:50135
Papyan, A.K., *See* Balayan, Z.K., 15:49291
Parail, V.V., *See* Klima, R., 15:50147
Pardo, R.C., ECR [electron cyclotron resonance] ion sources and applications with heavy-ion linacs, 15:49240 (R;US)
See Bogaty, J.M., 15:49241
Parera Lopez, J.J., Relativistic correction of the energy atomic levels, 15:49864 (RA;BR;In Spanish)
Park, I.S., Infrared absorption study of neutron-transmutation-doped germanium, 15:49074 (RA;US)
Parker, R.J., Recent developments in donor solvent upgrading (DRB), 15:48198 (RA;CA)
Parker, R.L., *See* Ander, M.E., 15:50107
Parkinson, D., *See* Leggett, S.A., 15:48183
Parks, C.V., *See* Bowman, S.M., 15:48229
See Brady, M.C., 15:48230
See Broadhead, B.L., 15:49160
See Lake, W.H., 15:48382
See Renier, J.P., 15:48231
Parks, E.K., *See* Winter, B.J., 15:48865
Parsa, Z., *See* Batchelor, K., 15:49225
Parsons, A., High pressure gas scintillation drift chambers with wave-shifter fiber readout, 15:49345 (J;US)
Parsons, B.K., *See* Bharathan, D., 15:48471
Parsons, J.M., *See* Bharathan, D., 15:48471
Parzer, I., *See* Gregoric, M., 15:48552
See Petelin, S., 15:48549
Pashchenko, A.B., *See* Bychkov, V.M., 15:49981
See Manokhin, V.N., 15:49985
Pask, J.A., *See* Loehman, R.E., 15:48943
Pasko, S.I., *See* Egorov, O.K., 15:49304

Passaiacqua, R.A., Iodine chemistry and transport calculations for the radioiodine test facility experiments (ACE-RTF) using the MITIMAKS code and the LIRIC data base, 15:49152 (R;CH)
Passell, L., *See* Majkrzak, C.F., 15:48857
Patel, K., Particle simulation of a two-dimensional electrostatic plasma, 15:50109 (R;IN)
Patera, E.S., *See* Levich, R.A., 15:48334
Pathak, B., Health effects of ionizing radiation, 15:49715 (R;CA)
Patil, P.G., Shipping, use, and disposal/recycle considerations for sodium/beta batteries in electric vehicle (EV) applications, 15:48838 (R;US)
Patkos, A., *See* Frei, Z., 15:50048
Patt, W.K., *See* Iwanczyk, J.S., 15:49325
Patterson, D.J., *See* Mitchell, R.R., 15:48836
Pattillo, S.G., *See* Smith, D.C., 15:48938
Paubert, G., *See* Encrenaz, Th., 15:49755
Pauwels, J., Certification of a uranium-238 dioxide reference material for neutron dosimetry (EC nuclear reference material 501), 15:48994 (R;FR)
Pavlo, P., *See* Klima, R., 15:50147
Pavlova, N.N., *See* Yushkov, A.V., 15:49990
Paya, D., *See* Blons, J., 15:50015
Payne, M.G., Large collective lamb shifts in high pressure noble gases, 15:49871 (R;US)
Pearman, G., *See* Chung, F., 15:49431
Pearson, E.W., *See* LeBaron, B.A., 15:48442
Pech, P., *See* Rainer, H.-D., 15:50148
Pedersen, B., *See* Raes, F., 15:48648
Pedraza, D.F., *See* Allen, W.R., 15:50069
See Caro, J.A., 15:48864
Peelle, E., Two citizen task forces and the challenge of the evolving nuclear waste siting process: Volume 1, 15:48341 (BA;US)
Pehl, R.H., *See* Strauss, M.G., 15:49352
Pei, S., *See* Dabrowski, B., 15:48910
Pei, S.Y., *See* Lightfoot, P., 15:48913
Peirs, D., *See* Raes, F., 15:48648
Pelekhov, V.I., *See* Guseva, E.V., 15:50016
Pellegrini, R., *See* Pani, R., 15:49657
Pellizzari, E.D., Measurements of exhaled breath using a new portable sampling method, 15:49538 (R;US)
Peng, Tsung-Hung, Oceanic CO_2 uptake and future atmospheric CO_2 concentrations, 15:49589 (R;US)
Peng, Yingcai, *See* Haymaker, R.W., 15:49924
Penionzhkevich, Yu.Eh., *See* Oganesyan, Yu.Ts., 15:49991
Penner, R.M., *See* Miskelly, G.M., 15:50108
Pennington, M.R., *See* Morgan, D., 15:49957
Pennycook, S.J., Compositional imaging of semiconductor interfaces by Z-contrast scanning transmission electron microscope (STEM), 15:48952 (R;US)
Pereira, N.S. de, *See* Barboza, M.F. de, 15:49148
Perepelkin, N.F., *See* Arsen'ev, A.V., 15:50160
Peresypkin, V.V., *See* Katerinchuk, P.A., 15:49943
Peretz, F.J., Advanced Neutron Source: The designer's perspective, 15:48404 (R;US)
Advanced Neutron Source: The users' perspective, 15:48403 (R;US)
Perez, A., *See* HcHargue, C.J., 15:48950
Perez-Mendez, V., *See* Cho, G., 15:49356
See Fujieda, I., 15:49324
Perneczky, L., *See* Toth, I., 15:48557
Perry, B.J., Quality control in computed tomography X-ray scanners: Tolerances, limiting values and appropriate measuring methods, 15:49682 (RA;GB)
Perry, D.L., X-ray photoelectron studies of thorium oxide and thorium oxide hydrate, 15:48939 (BA;US)
Persiani, P.J., Reprocessing input data validation, 15:48388 (R;US)
Persson, H., *See* Anderson, D., 15:50113
Pescatore, C., ^{14} C release failed spent fuel containers: Volume 1, 15:48379 (BA;US)
Petelin, S., Post-test calculation of SPE-2 with RELAP5/MOD2: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48549 (RA;XA)
See Gregoric, M., 15:48552
Peter, K., Potentially catalytic and conducting polyorganometallics, 15:49052 (RA;US)
Peter, R., *See* Gaudiot, G., 15:49242
Peters, J.E., Co-firing of natural gas and coal. Annual report, October 1988-September 1989, 15:48121 (R;US)
Peters, R.W., Hazardous waste characterization of solid wastes generated from clean coal technologies, 15:48091 (R;US)
Peterson, A.C., *See* Eaton, R.R., 15:48349
Peterson, D.W., *See* Sweet, J.N., 15:49191
Peterson, E., *See* Harris, C.B., 15:49035
Peterson, J.E., *See* Major, E.L., 15:48330
Peterson, R.W., Identification of facility constraints that impact transportation operations: Volume 1, 15:48239 (BA;US)
See Best, R.E., 15:48237
See Grady, S.T., 15:48238
Peterson, S.R., *See* Strenge, D.L., 15:49151
Peterson, T.W., *See* Shadman, F., 15:48112, 15:48113
Petitjean, C., Experiment for direct measurement of final sticking ω_s in muon catalyzed dt fusion, 15:50186 (RA;GB)
New results in muon catalyzed pd fusion, 15:50187 (RA;GB)
See Blaser, J.P., 15:50197
Petrov, N.M., Study of the effects in three-nucleon systems due to the violation of nuclear forces charge independence, 15:49946 (R;UA)
See Sitenko, A.G., 15:49945
Petrukhin, A.I., *See* Gorin, Yu.P., 15:49307
Petrushenko, R.P., *See* Nosov, V.I., 15:48596
Petrzilka, V.A., *See* Klima, R., 15:50147
Peyrusse, O., *See* Jacquemot, S., 15:50110
Pfeffer, J.T., *See* Suidan, M.T., 15:48093
Pflugfelder, G., Investigations of defined oxides for improving the determination of emissivity of high temperatures. Pt. 1 and 2. Pt. 1: Determination of emissivity and optical constants. - Pt. 2: Preparation and analysis of probes, 15:48874 (R;DE;In German)
Pfium, D.L., A resistance wire technique applied to heat transfer measurements in high aspect ratio fluidized beds, 15:48115 (R;US)
Phalen, R.F., Inhalation toxicology of combined acid and soot particles. Final report, 15:49719 (R;US)
Phelps, D.K., *See* Kuznetsov, A.M., 15:49031
Phelps, M.E., *See* Guerrero, T.M., 15:49699
Phillips, R.C., *See* Chen, C.H., 15:49206
Phillpot, S.R., *See* Rickman, J.M., 15:48860
Piancastelli, M.N., Resonant processes above the carbon 1s ionization threshold in benzene and ethylene, 15:49133 (RA;US)
See Lindle, D.W., 15:49132
Piano, R., *See* Cavalli-Sforza, M., 15:49359
Piantone, P., Hydrothermal alterations as natural analogues of radionuclide migration in granitic rocks, 15:48272 (R;FR;In French)
Picard, J., *See* Calan, C. de, 15:49922
Picard, R.R., *See* Pillay, K.K.S., 15:48302
Picciolo, J.J., *See* Dorris, S.E., 15:48914
Pichugin, V.E., Technique for calculation of electrostatic fields of high-current accelerator elements, 15:50174 (R;SU;In Russian)
Pieper, J.L., *See* Klem, M.D., 15:49193
Piercey, R.B., *See* Haskins, P.S., 15:49362
Piercy, R.B., A large-area, scintillation telescope for heavy ions, 15:49328 (J;US)
Piercy, R.J., Robotic inspection of prototype titanium diffusion-bond final-closure weld: Final report, 15:48235 (R;CA)
Pierri, M., BRST quantization of spinning relativistic particles with extended supersymmetries, 15:49959 (R;BR)
Pietarila, M., *See* Pitkaenen, H., 15:49636
Pigford, T.H., *See* Hwang, Y., 15:48304
See Zwahlen, E.D., 15:48380
Pignone, C., *See* Kahn, E., 15:48751
Pilavachi, P.A., Energy efficiency in industrial processes: Future R and D requirements: Proceedings of the CEC seminar, 15:48808 (R;LU)
Industrial processes: Proceedings of a contractors' meeting, 15:48809 (R;LU)
Pillay, K.K.S., International safeguards relevant to geologic disposal of high-level wastes and spent fuels: Volume 1, 15:48302 (BA;US)

Pilot, G., Decontamination of concrete by superficial melting with a new burner associated to a plasma (feasibility study), 15:48279 (R;FR;In French)
Pilot, M., *See* Rouviere, R., 15:48651
Pin, F.G., [Mobile robots and intelligent motion control]: Foreign trip report, August 18, 1990–August 25, 1990, 15:49163 (R;US)
Pinard, J., *See* Le Blanc, F., 15:50073
Pinault, M., *See* Rouviere, R., 15:48651
Pine, G.D., *See* Hamblin, D.M., 15:48771
Pisarski, R.D., Resummation and the gluon damping rate in hot QCD, 15:49918 (R;US)
Piskorz, J., *See* Scott, D.S., 15:48422
Pitblado, R, *See* Spieser, H., 15:48787
Pitkaenen, H., Pollution load on the gulf of Finland in 1982-1984, 15:49636 (R;FI)
Pitzer, K.S., Near-critical NaCl-H_2O: An equation of state and discussion of anomalous properties, 15:49041 (RA;US)
Physical chemistry with emphasis on thermodynamic properties, 15:49129 (RA;US)
See Schrieber, D.R., 15:49043
See Singh, R.R., 15:49042
See Yang, J.Z., 15:49044
Platchkov, S., Deuteron A(Q^2) structure function and the neutron electric form factor, 15:49904 (R;FR)
Piltz, H., Reactor transients tests for SNR fuel elements in HFR reactor, 15:48635 (RA;FR;In German)
Plodinec, M.J., The DWPF product and its qualification program: Volume 1, 15:48353 (BA;US)
See Chacey, K., 15:48326
Plummer, E.W., *See* Baddorf, A.P., 15:50068
Plundrak, P., *See* Kallinger, W., 15:49665
Plyaskin, V.I., *See* Manokhin, V.N., 15:49985
Plyushchaj, M.S., Relativistic massive particle with higher curvatures as a model for description of bosons and fermions, 15:49935 (R;SU)
Podlazov, L.N., *See* Ionov, A.I., 15:48574
See Lebedev, N.N., 15:48613
Podlesny, R., *See* Arya, R.R., 15:48462
Poe, C.H., The steady state solutions of radiatively driven stellar winds for a non-Sobolev, pure absorption model, 15:49847 (J;US)
Poeppel, R.B., *See* Dorris, S.E., 15:48914
See Singh, J.P., 15:48916
See Wu, J.L., 15:49205
Poignet, J.C., *See* Barbier, M.J., 15:48764
Poirot, I.S., Optical study and analysis of Pu^{4+} in single crystals of $ZrSiO_4$, 15:49020 (RA;US)
PoKempner, M., *See* Sowers, M.W., 15:49859
Poker, D.B., *See* Xia, W., 15:48951
Pokrovskij, Yu.E., Filamentation in quark plasma at finite temperatures, 15:49925 (R;SU;In Russian)
Pole, M.W., *See* Walker, D.G., 15:49413, 15:49414
Pollina, R.J., *See* Rosa, R.J., 15:48757
Pond, R.B., *See* Persiani, P.J., 15:48388
Pongpimai, N., *See* Ang, T.G., 15:48458
Ponsart, D., *See* Vasseur, C., 15:48375
Pontedeiro, A.C., *See* Galetti, M.R.S., 15:48550
Pontuschka, W.M., *See* Isotani, S., 15:50071
Pope, J.M., *See* Chacey, K., 15:48326
Pope, R.B., Radioactive materials packaging standards and regulations: Making sense of it all: Volume 1, 15:48236 (BA;US)
See Best, R.E., 15:48237
See Grady, S.T., 15:48238
See Peterson, R.W., 15:48239
Popov, N., *See* Gula, A., 15:50191
Popov, V.P., *See* Korenman, G.Ya., 15:50190
Popov, V.S., *See* Mur, V.D., 15:50098
Popovychev, S.V., *See* Zaveryaev, V.S., 15:50144
Popp, K., Safety and reliability of reactor pressure components - Research activities in the German Democratic Republic: Summary report, 15:48562 (RA;XA)
Porrachia, A., *See* Chatelard, P., 15:48534
Portnoy, W.M., *See* Cravey, W.R., 15:49220
Posselt, K., *See* Birkigt, W., 15:48401
Post, W.M. III, [Modeling of ecosystems]: Foreign trip report, August 21, 1990–September 4, 1990, 15:49412 (R;US)
Posthumus, R., *See* Montizaan, G.K., 15:49725
Potemkin, N.R., *See* Gorshkov, A.V., 15:50126
Potter, P.E., *See* Harding, J.H., 15:48872
Pougheon, F., *See* Bazin, D., 15:50003
Powers, T.B., *See* Wang, O.S., 15:48669
Powter, C.B., *See* Walker, D.G., 15:49413, 15:49414
Praet, R., *See* Gelbard, E.M., 15:50052
Praet, R.E., *See* Hendricks, J.S., 15:50060
Prager, S.C., *See* Sprott, J.C., 15:50115
Pratt, R.G., *See* Taylor, Z.T., 15:48794
Prausnitz, J.M., High-pressure phase equilibria in hydrocarbon-water (brine) systems, 15:48491 (RA;US)
See de Pablo, J.J., 15:49157
See Harvey, A.H., 15:50232
See Hooper, H.H., 15:49069, 15:49071
See Hu, Y., 15:49067
See King, R.S., 15:49158
See Rodgers, P.A., 15:49065
See Schwarz, B.J., 15:49066
See Topliss, R.J., 15:49068
See Wu, A.H., 15:49070
Pravikoff, M.S., *See* Bazin, D., 15:50003
See Gaimard, J.J., 15:50006
See Hubert, F., 15:50002
Preinhaelter, J., *See* Klima, R., 15:50147
Presta, M., Prospects for the French nuclear fuel management: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988, 15:48247 (RA;XA)
Price, D.L., *See* Saboungi, M.L., 15:48868, 15:48949
Prieto, M., Infrared profiles of five spiral galaxies: Proceedings of the 22. Eslab Symposium, 15:49804 (RA;FR)
Prilepskij, Yu.B., Simulation of angle interval distribution in collisions of relativistic nuclei and comparison with experiment: 1. High energy physics and computer technique, 15:50046 (RA;SU;In Russian)
Prior, M.H., Atomic physics, 15:49888 (RA;US)
See Hutton, R., 15:49889
Pritchard, D.A., An infrared imaging area sensor for tactical and physical security applications, 15:48394 (R;US)
Probst, W., Institutional status, challenges, and plans related to the MRS program: Volume 1, 15:48362 (BA;US)
Probst, W.C., *See* Madore, C.M., 15:48312
See Meier, D., 15:48377
Prolx, R., Experimental study of aeraulics heating. Final Report, 15:48767 (R;FR;In French)
Prokhorenko, E.M., *See* Zabela, A.G., 15:49235
Pronyaev, V.G., *See* Badikov, S.A., 15:49999
See Blokhin, A.I., 15:50009
See Manokhin, V.N., 15:49985
Prout, D., *See* Taddeucci, T.N., 15:50000
Provost, L.R., *See* D'Agostino, P.A., 15:49409
Pruett, D.P., *See* Imel, G.R., 15:48402, 15:48620
Pryse, S.E., *See* Kersley, L., 15:49855
Pufahl, D.E., *See* Ho, Y.A., 15:48166
Puget, J.L., Analogies between cometary, interplanetary and interstellar matter: Proceedings of the 22. Eslab Symposium, 15:49753 (RA;FR)
Pugh, C.E., Some ongoing R and D programs in the United States that relate to reactor pressure components: Summary report, 15:48524 (RA;XA)
Pulpan, Ya., *See* Borisov, A.A., 15:50056
Puolanne, J., *See* Pitkaenen, H., 15:49636
Puseljic, D., *See* Kennedy, C., 15:49329
Putaux, J.C., *See* Le Blanc, F., 15:50073
Putvinskij, S.V., *See* Zaveryaev, V.S., 15:50144
Puxley, P., Fluorescent molecular hydrogen emission from star-forming galaxies: Proceedings of the 22. Eslab Symposium, 15:49805 (RA;FR)
H53α emission from M82: Proceedings of the 22. Eslab Symposium, 15:49806 (RA;FR)
Pyrak-Nolte, L.J., *See* Meyer, L.R., 15:48343

Q

Qiao, Yong, *See* Jannson, T., 15:49153
Qu, Geping, China's perspective: Impact of greenhouse warming and response strategies, 15:49448 (RA;US)
Quan, C., Risk perspective on potential releases of ^{14}C from the geologic repository at Yucca Mountain: Volume 1, 15:48384 (BA;US)
Quenlart, D., Nuclear safety in France, 15:48542 (R;FR)
Quentin, P., *See* Bonche, P., 15:50013
Quern, P.A., *See* Kinner, N.E., 15:49633
Quinn, J.M., Viking data analysis. Final technical report, August 1986-March 1990, 15:49853 (R;US)
Quraishee, G.S., Global warming and rise in sea level in the south Asian seas region, 15:49438 (RA;US)
Qureschi, S., *See* Cho, G., 15:49356
Qureshi, A., Mitigating climate change: Strategies to finance retention of tropical forests, 15:49433 (RA;US)
Qureshi, S., *See* Fujieda, I., 15:49324

R

Rabaey, G.F., The intermediate-degree g-mode spectrum of the sun: Its properties and their implications to the solar neutrino paradox: Volume 571, 15:49844 (BA;US)
Rabani, S.R., *See* Isotani, S., 15:50071
Rabotnov, N.S., *See* Badikov, S.A., 15:49999
Radeka, V., *See* Debbe, R., 15:49323
See Fischer, J., 15:49267
See Yu, B., 15:49283
Radhakrishna, H.S., Thermal instability of underground power cables, 15:48678 (R;CA)
Radlein, D., *See* Scott, D.S., 15:48422
Raes, F., Radioactivity measurements in Europe after the Chernobyl accident: Part I: Air, 15:48648 (R;FR)
Raffelt, G., *See* Salati, P., 15:49848
Rahaman, M.N., Sintering of spherical glass powder under a uniaxial stress, 15:48984 (J;US)
Rahman, A.A., *See* Huq, S., 15:49453
Raia, T., *See* Pitkaenen, H., 15:49636
Rainbow, A.J., Mandatory quality assurance programmes for diagnostic radiology facilities in Ontario, Canada: Minimum requirements and limiting values: Tolerances, limiting values and appropriate measuring methods, 15:49664 (RA;GB)
Rainer, H.-D., Investigation of edge plasma by means of Langmuir probes, 15:50148 (RA;CS;In Russian)
Rainey, R.C.T., The loading on offshore structures from breaking waves, 15:49198 (R;GB)
Rainey, T.E., *See* Wang, O.S., 15:48669
Raj, S.V., *See* Freed, A.D., 15:48852
Rajnak, K., *See* Edelstein, N., 15:49019
Ramachandran, T.V., *See* Shaikh, A.N., 15:50062
Ramamoorthy, C.V., Language support for parallel computation. Final report, September 1988-September 1989, 15:50211 (R;US)
Ramanujam, A., Separation and purification of uranium product from thorium in thorex process by precipitation technique, 15:48223 (R;IN)
See Kartha, P.K.S., 15:48222
Ramayya, A.V., *See* Haskins, P.S., 15:49362
See Piercy, R.B., 15:49328
Ramirez, A.L., Prototype heater test of the environment around a simulated waste package: Volume 1, 15:48332 (BA;US)
Ramsdale, M.L., *See* Fitzgerald, M., 15:49675
Ramsey, J.A., *See* McElhaney, S.A., 15:49564
Ramsey, J.M., Collisional and electric-field ionization of laser-prepared Rydberg states in an ion trap mass spectrometer, 15:49872 (R;US)
Ramspott, L.D., MRS role in reducing technical uncertainties in geological disposal, 15:48291 (R;US)
Ransick, M.H., Interfacing a personal computer to an analog scanning electron microscopy for storing images on optical disks, 15:50235 (R;US)
Rao, T., *See* Batchelor, K., 15:49225
Rapaport, J., *See* Taddeucci, T.N., 15:50000
Rapp, P., *See* Ball, A.H., 15:49331
Rarldon, M.H., International Energy: Subject Thesaurus, 15:50249 (R;US)
Rashid, Y.R., Method for determining the fuel contribution to the source term in transport casks: Volume 1, 15:48387 (BA;US)
Ratavicius, A.J, *See* Hooren, D.L. Van, 15:48821
Ratledge, J.E., *See* Hill, C.V., 15:48381
Rauert, W., *See* Batsche, H., 15:48282
See Held, J., 15:49460
Rawl, R.R., *See* Pope, R.B., 15:48236
Ray, A.E., Metallurgical processes in multi-component rare earth-transition metal permanent magnet alloys. Final report, 15 May 1987-14 May 1990, 15:48854 (R;US)
Ray, R.M., *See* Becker, A.B., 15:48136
Rayiman, R.R., *See* Hutchins, G.D., 15:49349
Raymer, J.H., *See* Pellizzari, E.D., 15:49538
Raymond, A., Determination of iron 55 in nuclear wastes and effluents, 15:48991 (R;FR;In French)
Raymond, J.C., *See* Vrtilek, S.D., 15:49837
Raymond, K.N., *See* Edelstein, N.M., 15:49004
See Smith, P.H., 15:49005
See Zhu, D.H., 15:49059
Read, D., Geochemical modelling of the Broubster natural analogue site Caithness, Scotland, 15:48275 (R;FR)
Ream, W.K., A Nuisance Alarm Data System for evaluation of intrusion detectors, 15:49379 (R;US)
Reddick, R.C., *See* Ferrell, T.L., 15:49377
Reddmann, H., *See* Amberger, H.D., 15:49064
Redmond, R.J., *See* Easterling, J.B., 15:48363
Reed, B., A pyrolysis mill for fast pyrolysis of biomass, 15:48423 (RA;LU)
Reed, D.T., *See* Brush, L.H., 15:48288
Rees, S.I., General design memorandum, Gulfport Harbor, Mississippi. Design Memorandum Number 1. Appendix E. Thin-layer disposal. Final report, 15:49587 (R;US)
Rehbein, D.K., *See* Buck, O., 15:48877, 15:49189
See Thompson, R.B., 15:48919
Rehel, C., *See* Doucet, H.J., 15:50111
Rehm, H-J., Determination of high voltage: Methods of measurement, practicality, accuracy and regulations concerning tolerances: Tolerances, limiting values and appropriate measuring methods, 15:49673 (RA;GB)
Rehn, L.E., Irradiation-enhanced and-induced mass transport, 15:48900 (J;US)
Reichardt, K., *See* Gaertner, M., 15:48531
Reichert, C., *See* Fuhr, B.J., 15:48174
Reid, S.A., *See* Teper, B., 15:48286
Reijers, H.T.J., *See* Saboungi, M.L., 15:48868
Reimer, P.E., *See* Hertzog, D.W., 15:49286
Reinicke, B., *See* Dehli, M., 15:48829
Reinke, S.A., *See* Strauss, M.G., 15:49352
Reinsch, A.E., World oil market projections, 1990-2005, 15:48139 (R;CA)
World oil market projections, 1990-2005. Study No. 34, 15:48141 (R;CA)
Rempel, T.D., *See* Sprott, J.C., 15:50115
Renier, J.P., Reactor critical benchmark calculations for burnup credit applications, 15:48231 (R;US)
Renis, T.A., Validating detection probabilities for the ASSESS [Analytic System and Software for Evaluating Safeguards and Security] insider database, 15:48395 (R;US)
Reno, J.L., Optical characterization of CdZnTe/CdTe strained quantum wells, 15:48978 (R;US)
Repkov, A.V., *See* Kargal'tsev, V.V., 15:49208
Rescia, S., *See* Debbe, R., 15:49323
See Fischer, J., 15:49267
Ress, D., Design of thick apertures for high-resolution neutron penumbral imaging, 15:49327 (J;US)
Ressell, M.T., *See* Burrows, A., 15:49824
Rest, J., Kinetics of recrystallization and fission-gas induced swelling in high burnup UO_2 and U_3Si_2 nuclear fuels, 15:48218 (R;US)
Mechanistic interpretation of an observed rate dependence of low temperature swelling of irradiated uranium silicide dispersion fuels, 15:48217 (R;US)

Reusch, M., *See* Murphy, J.B., 15:49275
Revy, D., *See* Raymond, A., 15:48991
Reyes, Z.E., *See* Smith, P.H., 15:49005
Reynolds, J.G., An overview of hydrodesulfurization (HDS), hydrodenitrification (HDN), and hydrodemetalation (HDM) in petroleum chemistry, 15:48138 (BA;US)
See Biggs, W.R., 15:48175
See Wong, J., 15:48090
Reynolds, P.J., *See* Hammond, B.L., 15:50233
See Sun, Z., 15:49880
Reynolds, R., *See* Sanger, T., 15:49470
Rho, M., Strange goings-on in the proton: a case for sheshire cat, 15:49921 (R;FR)
Rhoads, R.E., *See* Daling, P.M., 15:48386
Rhodes, J.F., *See* Krause, R.F., 15:48942
Rhodes, L.F., *See* Strittmatter, R.J., 15:49028
Rhodes, T.L., *See* Ritz, C.P., 15:50112
Ribeiro, R.F., *See* Gomes, M., 15:49965
Ricco, A.J., SAW gas sensors based on acoustoelectric effects, 15:49123 (BA;US)
See Butler, M.A., 15:49388
Rich, J., *See* Shutt, T., 15:49344
Richard, A., *See* Bazin, D., 15:50003
Richard, D., Energy reliability and the planning of power generating equipment: Proceedings, 15:48672 (RA;CA)
Richard, J.R., High pressure thermobalance device application to the gasification of char obtained from tropical wood, 15:48433 (RA;LU)
Richard, P., [Atomic physics with highly charged ions]: Progress report, FY 1990, 15:49873 (R;US)
Richards, B.C., Uppermost Devonian and lower Carboniferous stratigraphy, sedimentation, and diagenesis, southwestern District of Mackenzie and southeastern Yukon Territory (NTS 95 B, C, F, and G), 15:49736 (R;CA)
Richards, D.R., *See* Dabrowski, B., 15:48910
Richards, G.N., Catalysis of carbon gasification: Influence of different modes of addition of catalysts. Annual report, January 1989-January 1990, 15:48081 (R;US)
Richards, P.G., *See* Hansen, R.A., 15:49402
Richards, P.L., *See* Hu, Q., 15:49319
Richardson, J.A., *See* Hale, H.J., 15:48357
Rickersten, L., *See* Alexander, D., 15:48355
Rickman, J.M., Molecular-dynamics study of grain-boundary migration in metals, 15:48860 (R;US)
Riddersma, J.A., Thermal performance and delivery capability of an electric water heater with a non-pressurized plastic tank, 15:48786 (R;CA)
Riddle, F.L. Jr., *See* Fowkes, F.M., 15:48084
Rider, B.F., *See* England, T.R., 15:49994
Rider, W.J., A vectorized heat transfer model for solid reactor cores, 15:48577 (R;US)
Riemann, T., *See* Bardin, D.Yu., 15:49949
Righi, J., *See* Miller, T.A., 15:48922
Rijpkema, J.E., *See* van Dalen, A., 15:48274
Riley, S.J., *See* Winter, B.J., 15:48865
Riling, G., *See* Clem, W.L., 15:48324
Rimondi, O., *See* Gambaccini, M., 15:49677, 15:49678
Rimpo, J.Y., *See* Hamblin, D.M., 15:48771
Ringdal, F., *See* Hansen, R.A., 15:49402
Rintamaa, R., *See* Toerronen, K., 15:48521
Ripple, E.S., *See* Moyer, B.A., 15:49088
Risch, T., Transference number calculations for sodium polysulfides, 15:49119 (RA;US)
Riseman, T.M., *See* Le, L.P., 15:48923
Risser, S.M., Theoretical calculations of the nonlinear dielectric function of inhomogeneous thin films, 15:48972 (R;US)
Ritchie, R.O., *See* Veirs, D.K., 15:49077
Ritz, C.P., Edge turbulence and transport: Text and ATF modeling, 15:50112 (R;US)
Ritzl, D., *See* Ziock, H.J., 15:49374
Rivelles, V.O., *See* Damgaard, P.H., 15:49958
See Gamboa, J., 15:50095
See Pierri, M., 15:49959
Rizeq, R.G., *See* Shadman, F., 15:48112
Rizzo, C., *See* Del Guerra, A., 15:49353
Roberson, C.W., Review of free-electron lasers, 15:49216 (R;US)
Roberts, D.R., Variable eigenmode excitation in the beach heating of two-ion-species mirror plasmas, 15:50120 (R;US)
Roberts, T.M., Elementary inversion, energy velocity, and a generalized Sommerfeld theorem, 15:50097 (R;US)
Robertson, I.M., *See* Vetrano, J.S., 15:48985
Robinson, G.C. Jr., *See* Naus, D.J., 15:48608
Robinson, G.N., Crossed-molecular-beam studies of the reactions of methyl radicals with iodoalkanes, 15:49884 (RA;US)
Dynamics of endoergic substitution reactions: I. Br + chlorinated aromatic compounds, 15:49882 (RA;US)
Dynamics of endoergic substitution reactions. II. Br + (CH_2CCl_2) → Cl + (CH_2CClBr), 15:49883 (RA;US)
Robinson, R.L., Far-infrared laser Stark spectroscopy of the Σ bending vibration of ArHCl, 15:48999 (RA;US)
Roblitz, E.S., *See* Russell, E.W., 15:48369
Roble, R.G., *See* Forbes, J.M., 15:49850
Roche, P.F., Infrared spectroscopy of dust: Proceedings of the 22. Eslab Symposium, 15:49759 (RA;FR)
Spectroscopy of galaxies in the mid-infrared: Proceedings of the 22. Eslab Symposium, 15:49796 (RA;FR)
Rockhold, M.L., Multi-dimensional modeling of unsaturated flow in the vicinity of exploration shafts and fault zones at Yucca Mountain, Nevada: Volume 1, 15:48347 (BA;US)
Rodgers, P.A., Correlation of liquid heat capacities for fossil fuels using characterization data, 15:49065 (RA;US)
Rodriguez, J.L., *See* Hughes, R.C., 15:48980
Rodriquez, J.L., *See* Klein, V.F., 15:49367
Roeder, H.W., *See* Hennig, D., 15:48546
Roehrig, H.D., Irradiation testing for fusion technology. Current programme and future plans of KfK, 15:50170 (RA;FR)
Roeske, F., *See* McWright, G., 15:49380
Roettger, H., *See* Ahlf, J., 15:48621
Rogers, J., *See* Batchelor, K., 15:49225
See Greimann, L., 15:48654
Rogers, L., *See* Debbe, R., 15:49323
See Fischer, J., 15:49267
Rogers, R.D., *See* Strittmatter, R.J., 15:49028
Rogers, W.L., *See* Hutchins, G.D., 15:49349
Rogova, V.D., *See* Ionov, A.I., 15:48574
Rohatgi, U.S., Bias in peak clad temperature predictions due to uncertainties in modeling of ECC bypass and dissolved noncondensable gas phenomena, 15:48664 (R;US)
Rollbuhler, R.J., *See* Brabbs, T.A., 15:49156
Romanov, V.A., *See* Bashmakov, V.S., 15:49249
Romanovskij, R.A., *See* Lebedev, S.G., 15:49257
Ronchi, C., *See* Gardani, M., 15:48619
Ros, J.P.M., *See* Slooff, W., 15:49724
Rosa, R.J., Corrosion and arc erosion in MHD channels: Quarterly progress report, January–March 1990, 15:48757 (R;US)
Rosen, R.K., Tris(methylcyclopentadienyl)uranium(III)-ammonia, 15:49060 (RA;US)
Rosenberg, E.I., *See* Gorbics, M.S., 15:49281
Rosenberg, Z., *See* Brar, N.S., 15:49389
Rosenblatt, G.M., Raman studies of surface processes, 15:49075 (RA;US)
See Chia, V.K.F., 15:49282
See Veirs, D.K., 15:49076, 15:49077
Rosengrant, L., Best demonstrated available technology (BDAT) background document for wastes from the production of chlorinated aliphatics F025. Volume 1. Final report, 15:49499 (R;US)
Final best demonstrated available technology (BDAT) background document for K031, K084, K101, K102, characteristic arsenic wastes (D004), characteristic selenium wastes (D010), and P and U wastes containing arsenic and selenium listing constituents. Volume 1, 15:49475 (R;US)
Final best demonstrated available technology (BDAT) background document for characteristic ignitable wastes (D001), characteristic corrosive wastes (d002), characteristic reactive wastes (D003), and P and U wastes containing reactive listing constituents. Volume 2, 15:49476 (R;US)

Final best demonstrated available technology (BDAT) background document for K001 (addendum) and U051 (creosote). Volume 3, 15:49477 (R;US)
Final best demonstrated available technology (BDAT) background document addendum for K015. Volume 4, 15:49478 (R;US)
Final best demonstrated available technology (BDAT) background document for K073. Volume 5, 15:49479 (R;US)
Final best demonstrated available technology (BDAT) background document for K021. Volume 6, 15:49480 (R;US)
Final best demonstrated available technology (BDAT) background document for K086 (ink-formulation-equipment cleaning wastes). Volume 7, 15:49481 (R;US)
Final best demonstrated available technology (BDAT) background document for K060. Volume 8, 15:49482 (R;US)
Final best demonstrated available technology (BDAT) background document for K061 (Addendum). Volume 9, 15:49483 (R;US)
Final best demonstrated available technology (BDAT) background document for K046 (Addendum). Volume 10, 15:49484 (R;US)
Final best demonstrated available technology (BDAT) background document for F006 waste waters (Addendum). Volume 13, 15:49487 (R;US)
Final best demonstrated available technology (BDAT) background document addendum for cyanide wastes. Volume 14, 15:49488 (R;US)
Final best demonstrated available technology (BDAT) background document addendum for acrylonitrile wastes (K011, K013, and K014). Volume 15, 15:49489 (R;US)
Final best demonstrated available technology (BDAT) background document addendum for F002 (1,1,2-trichloroethane) and F005 (benzene, 2-ethoxyethanol, and 2-nitropropane). Volume 16, 15:49490 (R;US)
Final best demonstrated available technology (BDAT) background for mercury-containing wastes D009, K106, P065, P092, and U151. Volume 17, 15:49491 (R;US)
Final best demonstrated available technology (BDAT) background document for P and U thallium wastes. Volume 18, 15:49492 (R;US)
Final best demonstrated available technology (BDAT) background document for vanadium-containing wastes (P119 and P120). Volume 19, 15:49493 (R;US)
Final best demonstrated available technology (BDAT) background document for barium wastes (D005 and P013). Volume 20, 15:49494 (R;US)
Final best demonstrated available technology (BDAT) background document for D006 cadmium wastes. Volume 21, 15:49495 (R;US)
Final best demonstrated available technology (BDAT) background document for chromium wastes D007 and U032. Volume 22, 15:49496 (R;US)
Final best demonstrated available technology (BDAT) background document for D008 and P and U lead wastes. Volume 23, 15:49497 (R;US)
Final response to BDAT related comments document. K043-K052, K036, K037. Volume 1-O, 15:48147 (R;US)
Final response to BDAT related comments document: General BDAT issues. Volume 1-A-2, 15:49516 (R;US)
Final response to BDAT related comments document: General BDAT issues. Volume 1-A-3, 15:49517 (R;US)
Final response to BDAT related comments document: D002. Volume 1-C, 15:49518 (R;US)
Final response to BDAT related comments document. D004: Characteristic wastes for arsenic and K, P, and U wastes containing arsenic and D010: Characteristic wastes for selenium. Volume 1-E, 15:49520 (R;US)
Final response to BDAT related comments document: D005: Characteristic wastes for barium, and P013 and D006: Characteristic wastes for cadmium. Volume 1-F, 15:49521 (R;US)
Final response to BDAT related comments document. D007. Characteristic wastes for chromium. Volume 1-G, 15:49522 (R;US)
Final response to BDAT related comments document: D008: Characteristic wastes for lead and P and U wastes containing lead. Volume 1-H, 15:49523 (R;US)
Final response to BDAT related comments document. D009, K044, K045, K047, D011, P119, P120, and P and U wastes. Volume 1-I, 15:49524 (R;US)
Final response to BDAT related comments document. Mixed radioactive hazardous wastes, polynuclear aromatic u wastes, halogenated aliphatic U wastes, non-halogenated aromatic U wastes, F002-f006, F019. Volume 1-J, 15:49525 (R;US)
Final response to BDAT related comments document. F025, K002-K008, K011, K013-15, K046, K061, K069. volume 1-k, 15:49526 (R;US)
Final response to BDAT related comments document. K017/K028-K029, K095-096, K022, K025, K035, K026, K083, K024. Volume 1-M, 15:49527 (R;US)
Final response to BDAT related comments document. Halogenated organic wastes. Volume 1-N, 15:49528 (R;US)
Final response to BDAT related comments document. Leachates. Volume 1-P, 15:49529 (R;US)
Final response to BDAT related comments document. Volume 1-Q, 15:49530 (R;US)
Final response to BDAT related comments document. Volume 1A-1. General BDAT issues, 15:49577 (R;US)
Final response to BDAT related comments document: D001. Volume 1-B, 15:49607 (R;US)
Final response to BDAT related comments document. K071 and K106: Mercury cell process wastes K086: Residues from ink production wastes containing cyanide. Volume 1-L, 15:49608 (R;US)
Final response to BDATt related comments document D003. Volume 1-D, 15:49519 (R;US)
Rosenzweig, C., *See* Balachandran, A.P., 15:49899
Ross, D., *See* Hirschon, A.S., 15:48077
Ross, J.R., *See* Imel, G.R., 15:48402
Ross, P.N., Electrode kinetics and electrocatalysis, 15:48840 (RA;US)
See Mayer, S.T., 15:48695
See Staud, N., 15:49104
Ross, R., *See* Shutt, T., 15:49344
Rossington, C.S., *See* Madden, N.W., 15:49330
Rostaing, M., *See* Galmiche, D., 15:50166
Rothman, R., *See* Darrough, M., 15:48385
Rothwarf, A., *See* Arya, R.R., 15:48462
Rothwell, T.M, Partial room brooding for poultry, 15:48788 (R;CA)
Rotolo, C., *See* Swoboda, C., 15:49336
Rotter, M., *See* Bernier, M.E.R., 15:49867
Rou, C.S., *See* Krauss, A.R., 15:48911
Rouan, J.P., *See* Richard, J.R., 15:48433
Rouleau, A., *See* Locat, J., 15:49586
Rouse, F., The electronics and data acquisition system for the wire imaging synchrotron radiation detector at the SLC, 15:49272 (J;US)
See Von Zanthier, C., 15:49268
Roussel, M., Calibration of photovoltaic cells and modules used for terrestrial applications, 15:48457 (R;FR;In French)
Roussiere, B., *See* Le Blanc, F., 15:50073
Rouviere, R., Adaptation of high pressure water jets with abrasives for nuclear installations dismantling, 15:48651 (R;FR;In French)
Roux, D., *See* Zemb, T., 15:49284
Rowan, W.L., *See* Ritz, C.P., 15:50112
Rowcliffe, A.F., [Mechanical behavior of ceramics and composites]: Foreign trip report, August 2, 1990–August 22, 1990, 15:48933 (R;US)
Rowe, W., *See* Kent, J., 15:49322
Rowe, W.A., *See* Ziock, H.J., 15:49374
Rowley, J.D., Correlation of chromosome patterns in leukemic cells of patients with exposure to chemicals and/or radiation: Progress report, January 1–August 20, 1990, 15:49655 (R;US)
Roy, C., *See* Locat, J., 15:49586
Rozmarynowski, P., *See* Ball, A.H., 15:49331
Rubin, A.E., *See* Veryutin, V.A., 15:49253
Rubin, L., State-of-the-art interior-piping-systems application: On-site H_2S/O_2 removal technology. Final report, June 1988-March 1989, 15:48190 (R;US)
Rubin, M.B., A continuum tensile failure model with friction, 15:49400 (R;US)
Ruchti, R., *See* Kennedy, C., 15:49329

Ruderman, M., *See* Tavani, M., 15:49841
Ruf, B.A., *See* Miller, W.H., 15:50229
Ruggles, M.B., *See* Ainsworth, R.A., 15:48580
Rulkar, P.B., Determination of non-metallic elements in actinide complexes by oxygen flask combustion (OFC): chlorine and fluorine, 15:48989 (R;IN)
Rumpf, J., *See* Hoehn, J., 15:48587
Rush, J.J., *See* Majkrzak, C.F., 15:48857
Russell, C.D., *See* Kersley, L., 15:49855
Russell, D.J., *See* Harris, C.B., 15:49037
Russell, E.W., Fabrication and closure development of nuclear waste containers for storage at the Yucca Mountain, Nevada repository: Volume 1, 15:48369 (BA;US)
Russell, G.M., *See* Anderson, S.T.G., 15:49081
Russell, J.H., *See* Chan, A.M.C., 15:48661
Russell, R.A., *See* Dorris, S.E., 15:48914
Rutenkroger, E.O., *See* Hill, C.V., 15:48381
Ruuskanen, J., Optical measuring methods, 15:49554 (RA;FI)
Ryabov, A.D., *See* Abramov, A.G., 15:49256
Ryan, J., *See* Kennedy, C., 15:49329
Ryan, P.A., High-temperature superconductivity applications for electronic warfare and microwave systems. Final report, March 1988-March 1990, 15:49390 (R;US)
Ryan, R.R., *See* Smith, P.H., 15:49090
Rybarcyk, L.J., *See* Taddeucci, T.N., 15:50000
Rye, R.R., Electron irradiation of poly(tetrafluoroethylene): Effect on adhesion and comparison with X-rays, 15:49146 (J;US)
Rykalin, V.V., *See* Kurchaninov, L.L., 15:49365
Rykov, V.L., *See* Krasnokutskij, R.N., 15:49300
Ryne, R.D., *See* Shay, H.D., 15:49238
Ryu, D., A model for the distribution of dark matter, galaxies, and the intergalactic medium in a cold dark matter-dominated universe: Volume 571, 15:49838 (BA;US)

S

Saboungi, M.L., Liquid alloys with strong interactions, 15:48868 (R;US)
Structure of molten salts, 15:48949 (R;US)
Sachleben, R.A., *See* Brown, G.M., 15:49647
See Burns, J.H., 15:49087
See Moyer, B.A., 15:49088
Sachtleben, J., *See* Rainer, H.-D., 15:50148
Sadoulet, B., *See* Parsons, A., 15:49345
See Shutt, T., 15:49344
Sadrozinski, H.F.W., *See* Ziock, H.J., 15:49374
Saeki, I., *See* Kikuchi, K., 15:49590
Saeki, Masakatsu, Behavior of radioactive organic iodide in an atmosphere of High Temperature Gas-cooled Reactor, 15:49149 (R;JP;In Japanese)
Saeteri, J., The development of an integrating tracer gas method for ventilation measurements, 15:48796 (R;FI;In Finnish)
Safronov, G.A., Production of high energy nuclei ^{4}He,^{3}He,^{3}H,^{2}H in interaction 10.1 GeV/c protons with Be,Al,Cu,Ta, 15:50032 (R;SU)
Sagalovich, V.V., *See* Koropov, A.V., 15:48884, 15:48885
Sagar, B., *See* Rockhold, M.L., 15:48347
Sagawa, Chiaki, *See* Saeki, Masakatsu, 15:49149
Sagawa, Hiroyuki, μ particle detector, 15:49313 (RA;JP;In Japanese)
Sahnoune, H., *See* Douss, N., 15:48781
Saiki, H., *See* Kimura, K., 15:48074
Sailor, M.J., *See* Miskelly, G.M., 15:50108
Sailor, W.C., *See* Taddeucci, T.N., 15:50000
Sakaguchi, Harutaka, Plan for focal plane polarimeter for Grand Raiden, 15:49317 (RA;JP;In Japanese)
Sakaguchi, I., Control of microbiofouling using bacteriophage. 2.: Detection of phages and fundamental study of their lytic effect on fouling bacteria, 15:48487 (R;JP;In Japanese)
Sakai, Yoshikazu, *See* Watanabe, Katsutoshi, 15:48882
Sakaki, Isao, *See* Okubo, Tsutomu, 15:48657
Sakamoto, Hiroshi, Development of second level trigger system based on a microprocessor array in the TRISTAN VENUS experiment, 15:49314 (RA;JP)
Sakamoto, R., *See* Kamimoto, M., 15:48475
Sakata, Fumihiko, Nuclear spectroscopy and quantum chaos, 15:50031 (R;JP)
Sakharov, V.P., *See* Kazakov, P.N., 15:50217
Sakharova, T.Yu., *See* Ionov, A.I., 15:48574
Salati, P., Thermal relaxation oscillations in horizontal-branch stars, 15:49848 (J;US)
Saleh, R.A., *See* Renis, T.A., 15:48395
Saleur, H., Notes on some algebraic structures common to integrable lattice systems and conformal field theories, 15:49963 (R;FR)
Salib, P., Testing of New Brunswick oil shale in R.P.C. test facility. Open File Report No. 90-2, 15:48199 (R;CA)
Salmon, G.M., A brief introduction to Revelstoke Project: Proceedings, 15:48444 (RA;CA)
Salolo, J.H., *See* Kjeldgaard, E.A., 15:48726
Salzbrenner, R., *See* Sorenson, K.B., 15:48240
Salzman, G.C., A clinical flow cytometry data analysis assistant, 15:49651 (R;US)
Sameh, A.A., *See* Anderson, D.M., 15:49063
Samet, J.M., Nitrogen dioxide and respiratory infection: Pilot investigations. Research report, January 1984-September 1987, 15:49536 (R;US)
Samojlov, V.M., *See* Kudryavtsev, A.E., 15:49940
Samuels, W.D., *See* Exarhos, G.J., 15:49085
San Sebastian, M., *See* Ball, A.H., 15:49331
Sanchez, L., *See* Villanueva, C., 15:48248
Sanders, S.C., *See* Miller, T.A., 15:48922
Sanders, T., *See* Thornhill, C.K., 15:48221
Sanders, T.L., *See* Lake, W.H., 15:48382
See Rashid, Y.R., 15:48387
Sanderson, C.A., *See* Williams, P.G., 15:49792
Sanger, T., Costs of alternate strategies for reducing nitrogen oxide and volatile organic compounds. Emissions from stationary sources in Ontario: Volume 2. Liquid and solid waste, analytical methods, environmental socio-economics, 15:49470 (RA;CA)
Sannier, J., *See* Broc, M., 15:48859
Sannikov, A.V., *See* Golovachik, V.T., 15:49301
Sannikov, V.V., *See* Gorshkov, A.V., 15:50126
Santos, D.I. dos, *See* Craievich, A.F., 15:48909
Sanuki, H., *See* Itoh, K., 15:50181
Saraceno, P., *See* Ceccarelli, C., 15:49781
Sarajkin, A.I., *See* Kurchaninov, L.L., 15:49365
Sarbukov, V.V., TEMP-8 module. Calculation of reactor point kinetics with increased accuracy, 15:48595 (R;SU;In Russian)
Sarff, J.S., *See* Sprott, J.C., 15:50115
Sartmadjiev, A., *See* Balabanov, E., 15:48555
Sasaki, Katsunori, *See* Sawa, Kazuhiro, 15:48630
Sasaki, Shigemi, *See* Konno, Masayuki, 15:49279
Sasaki, Shinobu, A method of using the inverse matrix for manipulator kinematics, 15:49162 (R;JP;In Japanese)
Sass, W.L., Low-cost cogeneration system controller development. Final report, May 1988-July 1989, 15:48823 (R;US)
Sastry, S.M., Growth and deformation mechanisms of refractory-alloy hybrid materials. Final report, September 1986-September 1989, 15:48903 (R;US)
Sataka, Masao, *See* Ikezoe, Hiroshi, 15:49259
Satija, S., *See* Majkrzak, C.F., 15:48857
Sattelberger, A.P., *See* Smith, D.C., 15:48938
See Van Der Sluys, W.G., 15:48219
Saukkoriipi, L., *See* Liimatainen, K.-R., 15:48831
Saunders, G.L., Air/Superfund national technical guidance study series. Development of example procedures for evaluating the air impacts of soil excavation associated with Superfund remedial actions. Final report, 15:49544 (R;US)
Sauvage, J., *See* Le Blanc, F., 15:50073
Sauve, J.L., *See* Hawke, R.S., 15:49167
Savant, Gajendra., *See* Jannson, T., 15:49153
Savard, G., *See* Le Blanc, F., 15:50073
Savornin, J., *See* Vasseur, C., 15:48375
Sawa, Kazuhiro, Analysis method of fractional release of cesium from fuel elements of HTTR, 15:48630 (R;JP;In Japanese)
Sawata, S., Development of the Fresnel-lens-type solar collector, 15:48474 (R;JP)
Sawyer, T.W., *See* D'Agostino, P.A., 15:49409

Saykally, R.J., Spectroscopy and structures of reactive intermediates, 15:49155 (RA;US)
See Blake, G.A., 15:49048
See Busarow, K.L., 15:49000, 15:49136
See Cohen, R.C., 15:49047, 15:49139
See Robinson, R.L., 15:48999
Scalfo, G.M., *See* Tjeerdema, R.S., 15:48161
Schachner, J., *See* Kallinger, W., 15:49665
Schaefer, R., *See* Lindquist, D.H., 15:48947
Schaller, K.H., *See* Orlowski, S., 15:48281
Scharlemann, E.T., *See* Shay, H.D., 15:49238
Schaus, P.S., *See* Chacey, K., 15:48326
Schechter, J., *See* Balachandran, A.P., 15:49899
Schell, G.S., *See* Kinner, N.E., 15:49633
Schiber, J.E., *See* Ewing, R.I., 15:49357
Schiffer, J.P., Some thoughts on opportunities with reactions using radioactive beams, 15:50023 (R;US)
Schinder, P.J., *See* Bludman, S.A., 15:50106
Schink, O., *See* Kallinger, W., 15:49665
Schmidt, H., *See* Weiss, P.S., 15:49885
Schmidt, H.P., *See* Pflugfelder, G., 15:48874
Schmidt, K.H., *See* Gaimard, J.J., 15:50006
See Hubert, F., 15:50002
Schmidt, R., *See* Waller, H., 15:48488
Schmidt, Th., *See* Rehm, H-J., 15:49673
Schmitt, B., Spectroscopy and physico-chemistry of CO:H_2O and CO_2:H_2O ices: Proceedings of the 22. Eslab Symposium, 15:49772 (RA;FR)
Schmitz, P.J., Structure of Au and Pt films on Pd(110): Deposition temperature and coverage dependent (1 times 2) and (1 times 3) reconstructions, 15:48878 (R;US)
Schneberk, D., Multiple-energy techniques in industrial computerized tomography, 15:49318 (R;US)
Schneider, D., *See* Hutton, R., 15:49889
Schneider, K.J., *See* Cooley, C.R., 15:48346, 15:48371
Schneider, R.E., Experimental study of the plasma-focus device as a charged-particle accelerator. Final report, October 1982-May 1985, 15:49223 (R;US)
Schreiber, J.G., *See* Shaltens, R.K., 15:48469
Schreiner-Skottke, G., Investigation of the permeation of radiocontrast agent into the experimentally irritated stratum corneum, 15:49692 (R;DE;In German)
Schrieber, D.R., Equation of state in the acentric-factor system, 15:49043 (RA;US)
Schroeder, J.A., *See* Kelly, D.L., 15:48667
Schryvers, D., High-resolution electron microscopy observations of athermal omega phase in Ti-Mo alloys, 15:48898 (R;US)
Schubert, W.K., *See* Hughes, R.C., 15:48980
Schuchman, J., *See* Murphy, J.B., 15:49275
Schueller, R.D., *See* Wawner, F.E., 15:48902
Schuez, G., *See* Koerber, H., 15:48637
Schull, W.J., *See* Yoshimoto, Yasuhiko, 15:49717
Schulte, K., Metal-matrix composites - a promising alternative to conventional alloys, 15:48908 (R;DE)
Schultz, E.E., *See* Johnson, G.L., 15:48615
Schultz, J., *See* Ball, A.H., 15:49331
Schultze, H., *See* Amberger, H.D., 15:49064
Schulz, W.W., *See* Horwitz, E.P., 15:48257
Schulze, D., Synchrotron x-ray sources and new opportunities in the soil and environmental sciences: Workshop report, 15:49565 (R;US)
Schumacher, F., *See* McWright, G., 15:49380
Schumacher, P.M., *See* Denning, R.S., 15:48663
Schutter, P. de, *See* Stubbe, E.J., 15:48556
Schwartz, C.W., *See* Naus, D.J., 15:48608
Schwartz, D.S., *See* Sastry, S.M., 15:48903
Schwartzkopf, L.A., The upper critical field of $HoBa_2Cu_3O_{7-\delta}$ for H || c, 15:48918 (R;US)
Schwarz, B.J., A correlation for thermodynamic properties of heavy fossil-fuel fractions, 15:49066 (RA;US)
Schwarz, S.A., *See* Xia, W., 15:48951
Schwarzenberger, P.M., A compact, rugged, high repetition rate CO_2 laser incorporating catalyst, 15:49212 (RA;US)
Schwehm, G., *See* Colangeli, L., 15:49754
Schwerer, O., ENDF/B-4: General purpose file 1974. Summary of contents and documentation, 15:50252 (R;XA)
Scime, E., *See* Sprott, J.C., 15:50115
Scott, C.A., *See* Belushkin, A.V., 15:50079
Scott, D.S., Thermal conversion of biomass to liquids by the Waterloo Fast Pyrolysis Process, 15:48422 (RA;LU)
Scrinzi, A., *See* Zmeskal, J., 15:50183
Seemann, J.R., *See* Sharkey, T.D., 15:48465
Seguin, H., *See* Kramer, H.M., 15:49671
Seido, M., *See* Matsumoto, T., 15:48935
Seiler, K.P., *See* Zahn, M.T., 15:49595
Seleznev, V.D., *See* Ovchinnikov, V.V., 15:48958
Selikhov, A.V., *See* Pokrovskij, Yu.E., 15:49925
Sellgren, K., Mapping and spectroscopy of the 3.3 μm feature in Orion: Proceedings of the 22. Eslab Symposium, 15:49773 (RA;FR)
Selove, W., *See* Kononenko, W., 15:49358
Semenets, Yu.M., Statistical simulation of Coulomb collisions in a plasma, 15:50131 (R;SU;In Russian)
Semenov, Yu.B., *See* Bogdzel', A.A., 15:49305
Sergeev, M.V., *See* Guseva, E.V., 15:50016
Serrano, J.R., *See* Josa, J.M., 15:48214, 15:48254
Servomaa, A., Patient equivalent phantoms in chest radiography: Tolerances, limiting values and appropriate measuring methods, 15:49674 (RA;GB)
Severson, W.J., *See* Nair, B.R., 15:49170
Shadman, F., Mechanisms of surface enrichment and adhesion of coal combustion particulates: Sixth and seventh quarterly reports, December 16, 1987–June 15, 1988, 15:48112 (R;US)
Mechanisms of surface enrichment and adhesion of coal combustion particulates: Eighth and ninth quarterly reports, June 16, 1988–December 15, 1988, 15:48113 (R;US)
Shaham, J., *See* Tavani, M., 15:49841
Shahinpoor, M., *See* Hawke, R.S., 15:49167
Shahnam, M., *See* Celik, I., 15:48109
Shaikh, A.N., A study of radon variation in dwelling during 1988, 15:50062 (R;IN)
Shakhbazyan, B.A., *See* Kechechyan, A.O., 15:50036
Shakirov, V.A., *See* Balashov, V.V., 15:50196
Shalimoff, G., *See* Anderson, D.M., 15:49063
Shalimoff, G.V., *See* Amberger, H.D., 15:49064
Shalicross, D.C., Fireflood ignition devices and methods, 15:48200 (J;US)
Shaltens, R.K., Preliminary designs for 25 kWe advanced Stirling conversion systems for dish electric applications, 15:48469 (R;US)
Shalunov, A.N., *See* Zaruchejskij, V.G., 15:49383
Shamichev, A.N., *See* Ageev, A.I., 15:49181
Shan, C., *See* Javandel, I., 15:48348
Shan-Hsin, Chiang, Reversing the atmospheric temperature warming in Taiwan, 15:49452 (RA;US)
Shang, C.C., Modified-Yee field solutions in the AMOS wakefield code, 15:49237 (R;US)
Shannon, J.D., Modeled sulfur deposition trends since 1990 in North America, 15:49456 (R;US)
Shapira, D., [An experiment at GSI/SIS to study the 4π detector system]: Foreign trip report, June 9–September 5, 1990, 15:49316 (R;US)
Shapira, H.B., [New techniques and design approaches of neutron scattering facilities]: Foreign trip report, July 1, 1990–July 30, 1990, 15:48407 (R;US)
Shapiro, B., Mechanism of action of radiation-protective agents: In-vivo distribution and metabolism of cysteamine-S-phosphate (MEAP). Annual report, 1 July 1968-30 June 1969, 15:49709 (R;US)
Shapiro, F., *See* Arya, R.R., 15:48462
Shapoval, A.N., *See* Arsen'ev, A.V., 15:50160
Shapoval, D.V., Threshold anomaly in doublet nd-scattering, 15:50033 (R;UA)
Shappert, L.B., *See* Best, R.E., 15:48237
Sharifullin, Z.N., *See* Zaruchejskij, V.G., 15:49383
Sharkey, T.D., Mild water stress effects on carbon-reduction-cycle intermediates, ribulose bisphosphate carboxylase activity, and spatial homogeneity of photosynthesis in intact leaves, 15:48465 (J;US)

Sharma, L.N., *See* Basu, A.S., 15:50061
Sharma, R., *See* Jones, G.K., 15:48313
Sharma, S., *See* Murphy, J.B., 15:49275
Sharp, S.L., *See* Ferrell, T.L., 15:49377
Shaw, A.J., *See* Brennan, A.G., 15:49669
Shaw, H., *See* Cole, D.R., 15:49739
Shaw, R.A., Simulation of three-dimensional hydrodynamic components with a one-dimensional transient analysis code, 15:48659 (R;US)
Shaw, R.W., *See* Young, J.P., 15:49870
Shaw, S.R., *See* Brown, M.J., 15:49213
Shaw, W., Investigation of the potential of fuzzy sets and related approaches for treating uncertainties in radionuclide transfer predictions, 15:48280 (R;FR)
Shay, H.D., Use of a FEL [free electron laser] as a buncher for a TBA [two-beam accelerator] scheme, 15:49238 (R;US)
Shay, M.R., A systems engineering cost analysis capability for use in assessing nuclear waste management system cost performance: Volume 1, 15:48364 (BA;US)
Assuring data quality for use in waste management system tradeoffs studies: Volume 1, 15:48360 (BA;US)
See Holter, G.M., 15:48825
Sheehan, J., *See* Batchelor, K., 15:49225
Sheehy, G., Organizational and spatial frameworks for state of the environment reporting, 15:48703 (R;CA)
Shen, W., *See* Sprott, J.C., 15:50115
Shen, Y.R., *See* Page, R.H., 15:49135
Shepherd, L.E., *See* Gibson, J.D., 15:48309
Shepherd, J.E., *See* Tao, W.C., 15:49395
Shevchenko, A.P., *See* Zaveryaev, V.S., 15:50144
Shi, K.C., *See* Dilmanian, F.A., 15:49346
Shibata, K., *See* Tajima, T., 15:49749
Shih, H., *See* Mansfeld, F., 15:48855
Shikhlyarov, K.K., *See* Kazaryan, S.P., 15:49290
Shimizu, Yoshio, Pair correlation of super-deformed rotation band, 15:50050 (RA;JP;In Japanese)
Shimkunas, A.R., *See* Thomas, S., 15:49381
Shimoda, Tadashi, Heavy ion secondary beam course, 15:49264 (RA;JP;In Japanese)
Shin, Y.W., SWAAM-code development and verification and application to steam generator designs, 15:48581 (R;US)
Shin-ichiro, Fujisawa, Application of ion beam sputtering for diffusion study in solids, 15:50065 (R;GB)
Shindoh, Masami, *See* Kunitomi, Kazuhiko, 15:48655
Shinn, J.L., *See* Wilson, J.W., 15:49716
Shinshima, K., *See* Sakaguchi, I., 15:48487
Shiozawa, Ken-ichi, *See* Fukushima, Susumu, 15:48997
Shiozawa, Shusaku, *See* Sawa, Kazuhiro, 15:48630
Shiraishi, Haruki, *See* Watanabe, Katsutoshi, 15:48882
Shirikova, N.Yu., *See* Solov'ev, V.G., 15:50041
Shirley, D.A., Photoelectron spectroscopy, 15:49130 (RA;US)
See Leung, K.T., 15:48962, 15:49134
See Lindle, D.W., 15:49132
See Medhurst, L.J., 15:49131
See Piancastelli, M.N., 15:49133
See Terminello, L.J., 15:48963
Shishkov, S.Yu., Synthesis of oneparticle excitation from two giant quantum monopoles, 15:50093 (R;SU;In Russian)
Shivakumar, B., *See* Debbe, R., 15:49323
See Fischer, J., 15:49267
Shlyapnikov, P.V., *See* Uvarov, V.A., 15:49927
Shmakova, N.L., *See* Norseev, Yu.V., 15:49150
Shmonin, V.L., *See* Ameev, S.Sh., 15:50043, 15:50047
Shook, C.A., *See* Gillies, R., 15:48172
Short, S.M., Acceptance of spent fuel of varying characteristics: Volume 1, 15:48227 (BA;US)
See McKee, R.W., 15:48358
Shotwell, L.R., *See* Voss, C.F., 15:48337
Shul'gina, N.B., *See* Lyutostanskij, Yu.S., 15:50028
Shutt, T., Development of a cryogenic dark matter detector, 15:49344 (J;US)
Shuvalov, L.A., *See* Belushkin, A.V., 15:50079
Shuvalov, R.S., *See* Krasnokutskij, R.N., 15:49300
See Kurchaninov, L.L., 15:49299
Shvedov, O.V., Experimental studying the altitude distribution of the $^{63}Cu(n,\gamma)$ reaction rates in the model of the TVR-M reactor core, 15:48627 (R;SU;In Russian)
Experimental studying the azimuthal-radial distributions of the $^{63}Cu(n,\gamma)$ reaction rates in the model of the TVR-M reactor core, 15:48628 (R;SU;In Russian)
Experimental studying the effects of horizontal experimental channels on the neutron field in the model of the TVR-M research reactor core, 15:48629 (R;SU;In Russian)
Sibirtsev, A.A., *See* Safronov, G.A., 15:50032
Sibiryak, Yu.G., *See* Mazurov, I.B., 15:49295
Sicha, M., *See* Dvoracek, J., 15:50149
Sicherman, A., *See* Renis, T.A., 15:48395
Sick, I., *See* Platchkov, S., 15:49904
Siddiqi, T.A., Implications of climate change for energy policies in Asia, 15:49426 (RA;US)
See Streets, D.G., 15:49454
Sienicki, J.J., *See* Farmer, M.T., 15:48643, 15:48644
Sikolenko, V.V., *See* Korenev, S.A., 15:50078
Silva, A.J. da, *See* Gomes, M., 15:49965
Silva, C.P.G. da, *See* Barboza, M.F. de, 15:49148
See Martinez, D.Y.F., 15:49713
Silva, R.J., *See* Nguyen, Son N., 15:49560
Silva, S.R. da, Isolation and purification of rabbit imunoglobulin (IgG) for the production of a second antibody for radioimunoassay, 15:49693 (R;BR;In Portuguese)
Silvennoinen, R., The optical parametrization of an aerial multispectral camera, 15:49599 (R;FI)
Simenog, I.V., *See* Shapoval, D.V., 15:50033
Simmons, M.L., Performance evaluation of the IBM RISC [reduced instruction set computer] System/6000: Comparison of an optimized scalar processor with two vector processors, 15:50224 (R;US)
Simpson, P.L., *See* Parker, R.J., 15:48198
Simpson, T.L., Compact representation of radiation patterns using spherical mode expansions: Final report, 15:49219 (R;US)
Simunic, J.L., Oxidation of chromium(II) by hydroxylamine-O-sulfonic acid, 15:49034 (R;US)
Singer, H.J., *See* Lester, M., 15:49857
Singer, K.D., *See* Cahill, P.A., 15:49084
Singer, M.M., *See* Tjoerdema, R.S., 15:48161
Singh, J.P., $YBa_2Cu_3O_x$ composites with improved toughness and strength, 15:48916 (R;US)
See Dorris, S.E., 15:48914
See Wu, J.L., 15:49205
Singh, M., A new generation of SPECT and PET systems based on position sensitive photomultipliers, 15:49363 (J;US)
Singh, O., *See* Murphy, J.B., 15:49275
Singh, R.R., An ionic system with critical point at 44°C, 15:49042 (RA;US)
Singh, S.K., *See* Wu, J.L., 15:49205
Singh, V., *See* Haymaker, R.W., 15:49924
Sisk, D.R., Neutron detection based on superheated materials, 15:49355 (J;US)
See Swinth, K.L., 15:49354
Sisterson, D.L., Summary of the NAPAP state of science report on deposition monitoring in North America, 1979–1987, 15:49457 (R;US)
Sitenko, A.G., An off-energy description of hadron-hadron interaction within the P-matrix approach, 15:49945 (R;UA)
Sitenko, Yu.A., On zero modes of the Dirac operator on noncompact two-dimensional surface in magnetic field, 15:49968 (R;UA;In Russian)
Sjarief, S.H., Isolation and properties of plasmids from Deinococcus radiodurans Sark, 15:49714 (R;JP)
Skeens, J.D., *See* Gorbics, M.S., 15:49281
Skipper, P.L., *See* Jankowiak, R., 15:49646
Skorovarov, S.V., *See* Gasilov, V.A., 15:50124
Skripova, M.V., *See* Bychkov, V.M., 15:49981
Skrzeczanowski, V., *See* Borowecki, M., 15:50142
Skuja, A., *See* Ball, A.H., 15:49331
Skwarnicki, T., *See* Woody, C.L., 15:48940
Sladen, J.A., The influence of placement methods on the in-situ density of hydraulic sand fills: Proceedings, 15:49199 (RA;CA)

Siedzinski, S., X-ray spectrometer for the T-15 tokamak, 15:50139 (RA;CS;In Russian)
Siepneva, L.I., *See* Gulyaev, V.A., 15:50136
Slooff, W., Integrated criteria document: Asbestos effects, 15:49537 (R;NL)
Integrated criteria document: PAHs, 15:49724 (R;NL)
Sloop, F.V., *See* Brown, G.M., 15:49647
Slyusarev, V.A., Amplitude detector, 15:49255 (R;SU;In Russian)
Smalheer, D.L., *See* Tjeerdema, R.S., 15:48161
Small, G.J., *See* Jankowiak, R., 15:49646
Small, M., *See* Gillies, R., 15:48172
Smid, J., *See* Hejna, J., 15:48584, 15:48585
Smirnitskij, V.A., *See* Egorov, O.K., 15:49304
Smirnov, A.P., *See* Dvornikova, N.A., 15:50128
Smirnov, G.N., *See* Safronov, G.A., 15:50032
Smirnov, S.E., *See* Malofeev, V.M., 15:48597
Smirnov, Yu.F., *See* Asherova, R.M., 15:50025
Smith, A.D., *See* Cramp, T.J., 15:48256
Smith, B., *See* Tangler, J., 15:48484
Smith, B.M., *See* Cole, D.R., 15:49739
Smith, D.B., *See* Miller, J.C., 15:48992
Smith, D.C., Low temperature organometallic chemical vapor deposition (OMCVD) of rhodium and iridium thin films, 15:48938 (BA;US)
See Van Der Sluys, W.G., 15:48219
Smith, D.E., *See* Harris, C.B., 15:49036, 15:49037
Smith, D.H., *See* Young, J.P., 15:49870
Smith, D.J., *See* Pellizzari, E.D., 15:49538
Smith, D.L., Microscopic integral cross section measurements in the Be(d,n) neutron spectrum for applications in neutron dosimetry, radiation damage and the production of long-lived radionuclides, 15:49980 (R;US)
See Loomis, B.A., 15:50167
Smith, D.M., *See* Bogush, G.H., 15:48973
See Lindquist, D.H., 15:48947
Smith, G., *See* Parsons, A., 15:49345
Smith, G.C., *See* Debbe, R., 15:49323
See Fischer, J., 15:49267
See Mathieson, E., 15:49326
Smith, I.M., *See* Brown, M.J., 15:49213
Smith, J.E., *See* Hardy, J.E., 15:48645
Smith, K.R., Developing countries and climate change: Implications for risk management, 15:49422 (RA;US)
Smith, M.F. Jr., Ecological characterization atlas of coastal Alabama: Map narrative, 15:49571 (R;US)
Smith, M.G., *See* Espey, B.R., 15:49799
Smith, P.H., Kinetically inert lanthanide amine complexes, 15:49005 (RA;US)
Proton and anion binding properties of an OCTA-Aza cryptand, 15:49090 (BA;US)
Smith, R.A., An overview of the vitrification of defense high-level waste at the Hanford site: Volume 1, 15:48340 (BA;US)
Smith, R.C., Ultra-fast voltage comparators for transient waveform analysis, 15:50246 (J;US)
Smith, R.D., Combined capillary electrophoresis and electrospray ionization mass spectrometry, 15:49025 (R;US)
Smith, R.E., Ion chromatography in the manufacture of multilayer circuit boards, 15:49209 (R;US)
Smith, S., *See* Faulkner, K., 15:49663
Smits, D.P., *See* Lester, M., 15:49857
Smykov, G.B., *See* Ageev, A.I., 15:49181
Smyrl, W.H., *See* Tribollet, B., 15:49118
Snelgrove, J.L., *See* Bretscher, M.M., 15:48609
Snell, K.H., *See* Obot, N.T., 15:49179
Snider, K.T., *See* Beugelsdijk, T.J., 15:49644
Snidvongs, K., *See* Chiang, Shan-Hsin, 15:49436
Sobajima, Makoto, *See* Nakamura, Takehiko, 15:48583
Soble, C.S., *See* Krauss, A.R., 15:48911
Sobolewski, Z., *See* Woody, C.L., 15:48940
Soda, Midori, *See* Yoshimoto, Yasuhiko, 15:49717
Soerensen, K., *See* Worsoee-Schmidt, P., 15:48810
Sokol, H., *See* Staud, N., 15:49104
Sokolovskij, M.V., *See* Arpishkin, Yu.P., 15:50219
See Basko, M.M., 15:50178
Soldatov, V.A., Thermodynamics of steam-turbine cycle with minimum coolant flow rate, 15:48603 (R;SU;In Russian)
Solheim, B., *See* Lawson, L.O., 15:48110
Solomon, L., *See* Murphy, J.B., 15:49275
Solov'ev, L.S., *See* Kolkunov, B.O., 15:50123
Solov'ev, V.G., Description of low-lying vibrational $K^{\pi} \neq 0^{+}$ states of deformed nuclei in the quasiparticle-phonon nuclear model, 15:50041 (R;SU)
Soluri, A., *See* Pani, R., 15:49657
Som, P., *See* Dilmanian, F.A., 15:49346
Somasundaram, S., *See* Drost, M.K., 15:48496
Somasundaran, P., Flotation and flocculation chemistry of coal and oxidized coals: Technical progress report, March 15, 1990–June 14, 1990, 15:48083 (R;US)
Somerscales, E.F.C., Effect of calcium sulfate on pool boiling of enhanced heat transfer surfaces, 15:49180 (R;US)
Sommer, W.F., *See* Ziock, H.J., 15:49374
Song, G.S, *See* Adams, W.A., 15:48755
Soong, S.-T., *See* Cho, H.-R., 15:49473
Soran, P.D., Calculation of Monte Carlo importance functions for use in nuclear-well logging calculations, 15:49375 (J;US)
Sorensen, N.R., *See* Hosking, F.M., 15:48897
Sorenson, K.B., Materials selection issues for structural components of transportation casks: Volume 1, 15:48240 (BA;US)
See Golliher, K.G., 15:49165
Soto, A., *See* Chiang, Shan-Hsin, 15:49436
Sotogawa, Hiroaki, *See* Sakaguchi, Harutaka, 15:49317
Souder, P., *See* Woody, C.L., 15:48940
Soukoulis, C.M., A theoretical investigation on structural, vibrational, and electronic properties of amorphous silicon, 15:48879 (R;US)
South, D.W., *See* Corio, M.R., 15:48485
Souza, A.L., Simplified model of a PWR primary circuit, 15:48561 (R;BR;In Portuguese)
Sowers, M.W., Distribution of the daily $F0F_2$ about the monthly median, 15:49859 (R;US)
Spalding, D.B., The combustion of liquid fuels, 15:48176 (R;GB)
Sparks, C.J., X-ray microprobe-microscopy, 15:49187 (R;US)
Spencer, B.W., *See* Farmer, M.T., 15:48643, 15:48644
Spencer, E., *See* Ziock, H.J., 15:49374
Spengler, J.D., *See* Samet, J.M., 15:49536
Spieler, H., *See* Haber, C., 15:49273
See Holland, S., 15:49342
Spieser, H., Growth room temperature control with water-source heat pumps, 15:48787 (R;CA)
Spink, D.A., *See* McCarley, R.E., 15:48937
Spinoglio, L., Far-infrared fine-structure lines in active galaxies: Proceedings of the 22. Eslab Symposium, 15:49807 (RA;FR)
See Ceccarelli, C., 15:49781
Spirin, V.I., *See* Bashmakov, V.S., 15:49249
Spirkov, V.I., *See* Zaruchejskij, V.G., 15:49383
Spirov, E.G., *See* Golovachik, V.T., 15:49301
Spitzig, W.A., *See* Biner, S.B., 15:48880
Spol'nik, Z.A., *See* Akhiezer, I.A., 15:48959
Spragins, C.W., *See* Sprott, J.C., 15:50115
Springer, R.W., *See* Ball, A.H., 15:49331
Sprnagle, P., *See* Roberson, C.W., 15:49216
Sprott, J.C., Confinement and fluctuations in the MST [Madison Symmetric Torus] reversed field pinch, 15:50115 (R;US)
Spyromilio, J., Carbon monoxide in supernova 1987A: Proceedings of the 22. Eslab Symposium, 15:49789 (RA;FR)
Sresty, G.C., Recycling of electric-arc-furnace dust, 15:48824 (R;US)
Srinivasan, S., *See* Appleby, A.J., 15:48759
St-Pierre, M, Determination of the acid level of weakly mineralized waters, 15:49634 (R;CA)
Stack, D.W., Modeling issues associated with production reactor safety assessment, 15:48660 (R;US)
Stahara, S.S., Development of a comprehensive magnetohydrodynamic model of solar-terrestrial interaction. Final report, 1 March 1986-30 September 1988, 15:49854 (R;US)
Stahl, D., A waste package strategy for regulatory compliance: Volume 1, 15:48321 (BA;US)
Stamer, P., *See* Cavalli-Sforza, M., 15:49359
Stammer, A., *See* Wu, A.H., 15:49070
Stanners, D., *See* Raes, F., 15:48648

Stansfield, S.A., An expert system for automated robotic grasping, 15:49164 (R;US)
Stanton-Hoyle, D., *See* Willman, A.J., 15:48792
Starner, S.H., *See* Bilger, R.W., 15:48438
Starostin, V.A., Plane channeling and radiation of ultrarelativistic electrons in thick crystals, 15:50070 (R;SU;In Russian)
Starovoĭtov, V.A., *See* Mal'tsev, I.G., 15:49254
Stasenko, J.E., *See* Bhatnagar, R., 15:48614
Staud, N., The corrosion of carbon black anodes in alkaline electrolyte: IV. Current efficiencies for oxygen evolution from metal oxide-impregnated graphitized furnace blacks, 15:49104 (RA;US)
Stearns, C.W., Accelerated image reconstruction for a cylindrical positron tomograph using Fourier domain methods, 15:49351 (J;US)
See Chesler, D.A., 15:50064
Stecher-Rasmussen, F., *See* Abrahams, K., 15:48624
Stehmeier, L., Bacterial evaluation of the biopolymer selective plugging field test at Standard Hill, Saskatchewan, 15:48132 (R;CA)
Stein, H.J., Formation and stability of As-H bonds in H-implanted GaAs, 15:49083 (R;US)
Stein, K.O., *See* Russell, E.W., 15:48369
Stein, R., DOE perspectives on the regulatory framework of the civilian radioactive waste management program: Volume 1, 15:48303 (BA;US)
Stel'makh, A.P., *See* Ierusalimov, A.P., 15:50035
Stelzer, H., *See* Gaimard, J.J., 15:50006
Stender, H. St., The relationship between medical diagnostic requirements and limiting values of technical and physical parameters for image production: Tolerances, limiting values and appropriate measuring methods, 15:49658 (RA;GB)
Stepanenko, M.M., X-ray monochromator for ion temperature measurements in the T-15 tokamak, 15:50138 (RA;CS;In Russian)
Stepanov, A.M., *See* Egorov, O.K., 15:49304
Stepanov, V.B., *See* Veryutin, V.A., 15:49253
Stephani, D., *See* Debbe, R., 15:49323
See Fischer, J., 15:49267
Stephens, J.J. Jr., *See* Sorenson, K.B., 15:48240
Stoppler, J., *See* Fuhr, B.J., 15:48174
Steringer, A., Selection and development of an easy to process electrolyte for decontamination by electropolishing, 15:48277 (R;FR;In German)
Sternberg, A., The excitation of molecular hydrogen and its significance: Proceedings of the 22. Eslab Symposium, 15:49775 (RA;FR)
Sternlieb, B.J., *See* Le, L.P., 15:48923
Stevenson, L., *See* Probst, W., 15:48362
Stevenson, T., Radon, 15:48798 (BA;US)
Stewart, C.C., *See* Salzman, G.C., 15:49651
Stewart, H.E., Field evaluation of grillage foundation uplift capacity: Final report, 15:48674 (R;US)
Stickney, R.G., Hanford Site radioactive solid waste acceptance criteria, 15:48292 (R;US)
Stieve, F-E., *See* Stender, H. St., 15:49658
Stiles, D.L., *See* Holter, G.M., 15:48825
See Shay, M.R., 15:48360
Stockman, H.W., *See* Carrigan, C.R., 15:49743
Stoeckel, J., A time-of-flight analyzer of low energy atoms (preliminary test on the CASTOR tokamak), 15:50143 (RA;CS)
See Dvoracek, J., 15:50149
See Zacek, F., 15:49876
Stokes, A.W., *See* Suggett, J., 15:48197
Stokes, H.H., *See* Corio, M.R., 15:48485
Stolbunov, V.S., *See* Lebedev, S.G., 15:49257
Stoops, J., *See* Connor, C., 15:48795
Storm, C.B., *See* Lee, Kien-Yin, 15:49392
Stout, B.E., The chemistry of plutonium(VI) in aqueous carbonate solutions, 15:49033 (R;US)
Stout, D.B., *See* Gregoire, C., 15:50008
Stoutland, P.O., C-H insertion and π-complex formation reactions of $(\eta^5\text{-}C_5Me_5)(PMe_3)Ir$ with ethylene: An intra- and intermolecular isotope-effect study, 15:49056 (RA;US)
The thermodynamic driving force for C-H activation at iridium, 15:49057 (RA;US)
Stradley, J.G., *See* Burch, W.D., 15:48224
Strafella, F., *See* Ceccarelli, C., 15:49781
Stralt, R.S., Risk of disclosure of sensitive information during warhead dismantlement, 15:48851 (R;US)
Strasizheim, W.E., Insights on pyritic sulfur in coal from image analysis, 15:48089 (R;US)
Strasizheim, W.E., Microcharacterization of coal components for beneficiation: Fossil energy quarterly report, April 1, 1989–June 30, 1989, 15:48087 (R;US)
Strauss, M.G., X-ray spectrometry in vivo a Si(Li)-NaI(T1) detector, 15:49352 (J;US)
Strazzulla, G., *See* Magazzu, A., 15:49786
Strebel, A., *See* Gaudiot, G., 15:49242
Street, R.A., *See* Cho, G., 15:49356
See Fujieda, I., 15:49324
Streets, D.G., Responding to the threat of global warming: Options for the Pacific and Asia, 15:49454 (RA;US)
US energy use: New technologies and policies in response to global warming, 15:49429 (RA;US)
Streitwieser, A., *See* Lyttle, M.H., 15:49062
Streitwieser, A. Jr., *See* Edelstein, N.M., 15:49004
See Eisenberg, D.C., 15:49061
Strenge, D.L., Chemical data bases for the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1, 15:49151 (R;US)
See Droppo, J.G. Jr., 15:49547, 15:49548, 15:49583
Striter, A., Licensing analysis of steam generator tube plugging: Influence on LB-LOCA: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48558 (RA;XA)
See Petelin, S., 15:48549
Strittmatter, R.J., Readily-accessible oxidation of d^0 organozirconium compounds: The electronic structure of $(\eta^5\text{-}C_5H_5)_3ZrX$ compounds, 15:49028 (BA;US)
Strother, S.C., Measuring PET scanner sensitivity: Relating count rates to image signal-to-noise ratios using noise equivalent counts, 15:49350 (J;US)
Strous, L.H., Predictions of infrared recombination lines in stellar winds of hot stars: Proceedings of the 22. Eslab Symposium, 15:49790 (RA;FR)
Strouse, G.F., *See* Worl, L.A., 15:49143
Struminsky, B.V., *See* Grdlichka, E.S., 15:49947
Stuart, A.L., *See* Zalkin, A., 15:49010
Stubbe, E.J., DOEL 4 - loss of external load transient: Simulation and analysis: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48556 (RA;XA)
Studenikin, A.I., Method of exact solutions in investigating the electromagnetic field influence on different quantum processes, 15:49944 (R;UA;In Russian)
Stults, S.D., $[Li(Me_2NCH_2CH_2NMe_2)_2]\text{-}[Li_2(Me_2NCH_2CH_2NMe_2)_2(\mu\text{-}\eta^5,\ \eta^5\text{-}MeC_5H_4)]\text{-}[(\eta^5\text{-}MeC_5H_4)_6U_2(\mu\text{-}Me)]_2$: A compound with symmetrically bridging MeC_5H_4 and Me groups, 15:49006 (RA;US)
Stump, D.M., *See* Budiansky, B., 15:48904
Sturchio, N.C., *See* Cole, D.R., 15:49739
Stutzki, J., *See* Genzel, R., 15:49763
Subbaramu, M.C., *See* Shaikh, A.N., 15:50062
Subramanian, M.S., *See* Ruikar, P.B., 15:48989
Subramany, *See* Ball, A.H., 15:49331
Sudo, Yukio, Present status of heat transfer in narrow gap rectangular channel, 15:49185 (RA;JP;In Japanese)
See Kunitomi, Kazuhiko, 15:48655
Suemmerer, K., *See* Gaimard, J.J., 15:50006
Sugai, O., *See* Sakaguchi, I., 15:48487
Suganuma, Masayuki, *See* Higuchi, Kenji, 15:50221
Sugarbaker, E., *See* Taddeucci, T.N., 15:50000
Suggett, J., Experiences with in situ monitoring instrumentation at AOSTRA's [Alberta Oil Sands Technology and Research Authority] underground test facility, 15:48197 (RA;CA)
Sugimoto, Makoto, *See* Konno, Masayuki, 15:49279
Suidan, M.T., Anaerobic fluid-bed treatment of coal conversion wastewater: Tenth quarterly technical progress report, November 15, 1988–February 15, 1988, 15:48093 (R;US)
Sullivan, J.C., *See* Stout, B.E., 15:49033
Sullivan, P.J.E., *See* Khoury, G.A., 15:48971

Sumiyoshi, Takayuki, Measurement of V_{ub}, 15:49913 (RA;JP;In Japanese)
Sun, L.M., *See* Douss, N., 15:48781
Sun, Z., Monte Carlo study of electron correlation functions for small molecules, 15:49880 (RA;US)
Surguchev, V.V., *See* Ovchinnikov, V.V., 15:48958
Sushkov, O.P., On the electronic structure of high temperature superconductors: Nonalloyed CuOsub 2 plane, 15:50077 (R;SU;In Russian)
Sushkov, V.V., *See* Kurchaninov, L.L., 15:49299
Susoeff, A.R., *See* Hawke, R.S., 15:49167
Suszcynsky, D.M., Secondary-electron yield measurements from metals impacted by high- velocity ions, electrons, and molecules, 15:50084 (R;US)
Sutin, N., *See* Zhang, X., 15:49095
Sutton, R.S., *See* Liepins, G.E., 15:50214
Suvorov, A.P., *See* Baranaev, Yu.D., 15:48582
Suzuki, K., Development of buried cable location survey system by underground rader for power distribution cables under pavements, 15:48673 (R;JP;In Japanese)
Suzuki, Masatoshi, The design and construction of the neutron guide tubes in JRR-3, 15:48631 (R;JP;In Japanese)
Suzuki, Mitsuhiro, An intermediate break BWR LOCA test (RUN 991) at ROSA-III: Simulation of ECCS line break LOCA phenomena, 15:48656 (R;JP)
Svalter, N.F., *See* Costa, I., 15:49962
Swaja, R.E., Results of the radiological survey at the Granite City Steel facilty, Granite City, Illinois, 15:49575 (R;US)
Swall, L.M., *See* Tjeerdema, R.S., 15:48161
Swan, F.H., *See* Gibson, J.D., 15:48309
Swartz, C.K., *See* Weinberg, I., 15:48459
Sweet, J.N., Short and long loop manufacturing feedback using a multi-sensor assembly test chip, 15:49191 (R;US)
Swinth, K.L., Survey instrument response to beta radiations, 15:49354 (J;US)
See Sisk, D.R., 15:49355
Swoboda, C., A high rate FASTBUS silicon strip readout system, 15:49336 (J;US)
See Barsotti, E., 15:49274
Symolon, P.D., Scaling of two-phase flow regimes in a rod bundle with freon, 15:48658 (R;US)
Szabados, L., *See* Ezsoel, G., 15:48548
Szawlowski, *See* Iwanczyk, J.S., 15:49325
Szczurek, J., *See* Kulig, M., 15:48551

T

Taddeucci, T.N., Cross section and analyzing power for quasifree (p,n) reactions, 15:50000 (R;US)
Tadokoro, Yoshihiro, *See* Takeda, Takeshi, 15:48576
Taft, C.A., *See* Braga, M., 15:49046, 15:49881
Tajima, T., On the origin of cosmological magnetic fields, 15:49749 (R;US)
See Hanami, H., 15:49748
Takahashi, Y., *See* Ainsworth, R.A., 15:48580
See Kamimoto, M., 15:48475
Takeda, S., *See* Watanabe, Y., 15:49591
Takeda, Takeshi, A study on steam reforming process using nuclear heat of VHTR, 15:48576 (R;JP;In Japanese)
Takeshita, T., *See* Nakahara, J.F., 15:48956
Takeuchi, S., *See* Kamo, T., 15:48934
Takhtamyshev, G.G., *See* Gramenitskij, I.M., 15:49306
Takiguchi, Takashi, *See* Yamamura, Yasunori, 15:50087
Talonpoika, T., Calculation of transport and radiation properties of flue gases, 15:49463 (R;FI;In Finnish)
Talybov, V.M., Diagnostics of impurity and neutral components of tokamak plasma by the resonance fluorescence method, 15:50130 (R;SU;In Russian)
Tamai, Kunio, Electromagnetic shower calorimeter, 15:49310 (RA;JP;In Japanese)
Tanabe, Tatsuhiko, *See* Watanabe, Katsutoshi, 15:48882
Tang, P., *See* Fang, Z., 15:50247
Tang, X.X., *See* Lightfoot, P., 15:48913
Tang, Y.N., *See* Dilmanian, F.A., 15:49346
Tanger, J.C. IV, *See* Pitzer, K.S., 15:49041
Tangler, J., Atmospheric performance of the special-purpose Solar Energy Research Institute (SERI) thin-airfoil family: Final results, 15:48484 (R;US)
Tanimoto, Morimitsu, B meson physics on Y (4s), 15:49952 (RA;JP)
Tannenbaum, S.R., *See* Jankowiak, R., 15:49646
Tanner, L.E., *See* Schryvers, D., 15:48898
Tao, W.C., Aluminum metal combustion in water revealed by high speed microphotography, 15:49395 (R;US)
Taplovaara, M., *See* Servomaa, A., 15:49674
Tarvainen, K., Energy conservation and hospital hygiene, 15:48785 (R;FI;In Finnish)
Taseka, Kanji, *See* Suzuki, Mitsuhiro, 15:48656
Tashenov, T.B., *See* Abdullin, Kh.A., 15:50081, 15:50083
Tata, X., *See* Baer, H., 15:49907
Tatara, Gen, *See* Yamamoto, Hisashi, 15:48917
Tavani, M., Self-sustained mechanism of mass transfer and evolution of very low mass x-ray binaries: Volume 571, 15:49841 (BA;US)
Tawara, Hiro, *See* Yamamura, Yasunori, 15:50087
Taylee, R.L., *See* Hertzog, D.W., 15:49286
Taylor, J., *See* Unsworth, M.D., 15:48265
Taylor, J.B., Natural current profiles in a tokamak, 15:50118 (R;US)
Taylor, Z.T., Comparison of ELCAP data with lighting and equipment load levels and profiles assumed in regional models, 15:48794 (R;US)
Temiraliev, A.T., Partial inelasticity coefficients in hadron-nucleus interactions: 1. High energy physics and computer technique, 15:50045 (RA;SU;In Russian)
Templeton, D.H., *See* Zalkin, A., 15:49014
Templeton, L.K., *See* Zalkin, A., 15:49014
Tenenbaum, P., *See* Ziock, H.J., 15:49374
Teper, B., Assessment of the iron-based, stressed-shell container, 15:48286 (R;CA)
Ter-Antonyan, S.V., *See* Avakyan, V.V., 15:49288
Terashima, Y., *See* Ohsawa, Y., 15:49825
Terazawa, Hidezumi, More sum rules for quark and lepton masses, 15:49939 (R;JP)
Terlain, A., *See* Broc, M., 15:48859
Terminello, L.J., Surface geometry of (1 x 1)PH_x/Ge(111) determined with angle-resolved photoemission extended fine structure, 15:48963 (RA;US)
See Leung, K.T., 15:48962
Ternay, A.L., Preparation of potential radioprotective agents derived from aminothiols. Annual report, 16 July 1985-15 July 1986, 15:49706 (R;US)
Terrell, J., The 1973 x-ray outburst of 4U1145-61: Volume 571, 15:49842 (BA;US)
Teschendorff, V., *See* Austregesilo, H., 15:48533
Texeira, R.H., *See* Goodman, B.J., 15:48833
Th, *See* Ritz, C.P., 15:50112
Thaman, R.R., Coastal reforestation and agroforestry as immediate ameliorative measures to address global warming and to promote sustainable habitation of low-lying and coastal areas, 15:49435 (RA;US)
Theiss, T.J., Recommendations for the shallow-crack fracture toughness testing task within the HSST [Heavy-Section Steel Technology] Program, 15:48571 (R;US)
Thekkadath, G., *See* Le Blanc, F., 15:50073
Thiel, P.A., *See* Schmitz, P.J., 15:48878
Thiele, B.A., KFA Neutron irradiation programme on materials for high heat load components of fusion devices, 15:50171 (RA;FR)
Thomas, K.W., *See* Pellizzari, E.D., 15:49538
Thomas, M., *See* Murphy, J.B., 15:49275
Thomas, R.R., *See* Kack, G.J., 15:48498
Thomas, S., Picosecond intensifier gating with a plated webbing cathode underlay, 15:49382 (R;US)
Sub-nanosecond intensifier gating using heavy and mesh cathode underlays, 15:49381 (R;US)
Thomas, W.R., *See* Stack, D.W., 15:48660
Thompson, R.B., Characterizing closure asperities by ultrasonic measurements, 15:48919 (R;US)
See Buck, O., 15:48877, 15:49189

Thompson, R.S., Fluctuations and high-T_c superconductivity, 15:48930 (RA;US)
Thomson, G.M., *See* Bossoli, R.B., 15:49408
Thonnard, N., *See* Brown, G.M., 15:49647
Thornhill, C.K., Development of a crud particle size distribution and its effect on cask source term and containment analyses: Volume 1, 15:48221 (BA;US)
Thornton, J.D., *See* Lawson, L.O., 15:48110
Thorson, I.M., *See* Beveridge, J.L., 15:49265
Thrall, R., Field investigation of domestic hot water tanks as space heating appliances: Final report, 15:48782 (R;CA)
Thresher, R.W., *See* Hock, S.M., 15:48483
Tice, D.R., *See* Dolphin, A.S., 15:48894
Tichy, M., *See* Dvoracek, J., 15:50149
Tikhonov, V.V., *See* Krasnokutskij, R.N., 15:49300
Tikhonova, L.A., *See* Zlatanov, Z., 15:49950
Tikhy, M., *See* Borisov, A.A., 15:50056
Timoshenko, G.N., The high-energy neutron spectrometry in mixed indirectional radiation fields behind accelerator shielding, 15:49261 (R;SU)
Tindall, W., *See* McWright, G., 15:49380
Tingle, T.N., Organic chemistry of mantle-derived xenoliths: Assessing the possibilities for deep sources of natural gas. Biennial report, November 1987-November 1989, 15:48179 (R;US)
Tinsman, J., *See* Von Zanthier, C., 15:49268
Tiomno, J., *See* Lima, J.A.S., 15:49746
Titarenko, N.N., *See* Badikov, S.A., 15:49999
Titarenko, Yu.E., *See* Shvedov, O.V., 15:48627
Titov, V.M., *See* Aul'chenko, V.M., 15:49207
Tjeerdema, R.S., Toxicology of oil-spill cleanup agents. Final report, 15:48161 (R;US)
Tkacek, S., *See* Haber, C., 15:49273
Tkach, Yu.V., *See* Balakirev, V.A., 15:50159
Tkalya, E.V., Vacuum polarization of electromagnetic field and electrodynamic processes on nucleus, 15:49897 (R;SU;In Russian)
Tobias, C.W., Engineering analysis of electrolytic gas evolution, 15:49101 (RA;US)
Surface morphology of metals in electrodeposition, 15:48684 (RA;US)
See McVay, L., 15:48692
See Whitney, G.M., 15:49102
Todoroki, J., *See* Itoh, K., 15:50181
Todoroki, Jiro, Adiabatic invariant and evaluation of particle loss in helical torus, 15:50180 (R;JP)
Toerronen, K., Overview of the recent results of the safety related research in pressure boundary components of Finnish nuclear power plants: Summary report, 15:48521 (RA;XA)
Tokmoldin, S.Zh., *See* Abdullin, Kh.A., 15:50081
Tokunaga, A.T., *See* Sellgren, K., 15:49773
Tollestrup, A., *See* Haber, C., 15:49273
Tolochkov, S.V., *See* Shvedov, O.V., 15:48627
Tolstov, K.D., *See* D'yachenko, V.M., 15:49260
Tomanek, D., *See* Zhang, S.B., 15:50085
Tomaszewski, K., *See* Veresczinski, Z., 15:50135
Tomita, Kenji, *See* Watanabe, Kazuya, 15:50105
Tomsia, A.P., *See* Loehman, R.E., 15:48943
Tong, G.T., Improved Fischer-Tropsch Synthesis catalysts for indirect coal liquefaction: Quarterly technical progress report No. 8, 1 July–30 September 1987, 15:48075 (R;US)
Tong, X., *See* Brush, L.H., 15:48288
Tonn, B.E., Artificial intelligence for subject interviewing, 15:48699 (R;US)
Topliss, R.J., Computational aspects of a noncubic equation of state for phase equilibrium calculations. Effect of density-dependent mixing rules, 15:49068 (RA;US)
Torgeson, D.R., *See* Baker, D.B., 15:50076
See Ibanez-Meier, R., 15:50075
Tosten, M.H., *See* Bibler, N.E., 15:48982
Toth, I., Analysis of loop asymmetry in Paks nuclear power plant in the event of a cold leg break: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48557 (RA;XA)
Toti, A., *See* Gambaccini, M., 15:49677
Totto, L., *See* Fridley, D., 15:49428
Touzain, P., *See* Barbier, M.J., 15:48764
Townsend, L.W., *See* Wilson, J.W., 15:49716
Towse, D., *See* Ramirez, A.L., 15:48332
Traegner, U.K., *See* Suidan, M.T., 15:48093
Tram, H.N., *See* Willis, H.L., 15:48749
Travis, B.J., Numerical models of 2-D and 3-D geophysical convection, 15:49740 (R;US)
See Birdsell, K.H., 15:48308
Trebes, J., *See* Yorkey, T., 15:49652
Trekhov, B.E., *See* Ionov, A.I., 15:48574
Tremaine, K.R, *See* Wong, R.K.W., 15:49455
Trendler, R., *See* Swoboda, C., 15:49336
Treptow, K., *See* Swoboda, C., 15:49336
Tret'yakova, S.P., *See* Ogloblin, A.A., 15:50017
Trevino, J., *See* Thomas, S., 15:49382
Triboilet, B., Determination of the diffusion coefficient from impedance data in the low-frequency range, 15:49118 (RA;US)
Trickl, T., Ultrahigh-resolution (1+1) photoionization spectroscopy of KrI: Hyperfine structures, isotope shifts, and lifetimes for the n = 5,6,7 4^5ns Rydberg levels, 15:49886 (RA;US)
See Cromwell, E., 15:49140
Trowbridge, L.D., Gas-phase chemical reactivity of CFC-114 [Chloro-fluoro-carbons-114] and potential replacements: Part 1, CFC-114 reactivity with Fsub 2 and UFsub 6, 15:48216 (R;US)
Trowsdale, D.R., *See* Kack, G.J., 15:48498
Trsic, M., Hartree-Fock integral method, 15:49862 (RA;BR;In Portuguese)
Trubnikov, B.A., *See* Vlasov, V.P., 15:49809
Trudell, L.G., *See* Mason, G.M., 15:48206
Trudell, M.R., Plains hydrology and reclamation project: Spoil ground-water chemistry and its impacts on surface water, 15:48098 (R;CA)
Truett, L.F., *See* Loffman, R.S., 15:49391
Truhlar, D.G., Quantum mechanical and semiclassical studies of tunneling in hydrogen atom transfer reactions and processes involving hydrogen on metal surfaces, 15:49086 (BA;US)
Tsai, Y.M., *See* Thompson, R.B., 15:48919
Tsang, R.H.K, *See* Cragg, C.B.H., 15:48970
Tsang, T.Y.F., *See* Batchelor, K., 15:49225
Tsangaris, A.V., Municipal solid waste feasibility of gasification with plasma arc: Phase 2. Environmental analyses: Volume 2. Liquid and solid waste, analytical methods, environmental socio-economics, 15:48436 (RA;CA)
Tschetter, M.J., *See* Nakahara, J.F., 15:48956
Tse, D.S., *See* Hirschon, A.S., 15:48077
Tsibulya, A.M., *See* Blokhin, A.I., 15:50009
Tsui, D.C., *See* Jones, E.D., 15:48975
Tsuji, Hirokazu, *See* Watanabe, Katsutoshi, 15:48882
Tsukuma, Hidehiko, *See* Sakata, Fumihiko, 15:50031
Tsunematsu, Toshihide, *See* Kamada, Yutaka, 15:50156
Tuck, M.R., *See* Sweet, J.N., 15:49191
Tuffs, R.J., Detection of SN1986j in NGC891 at millimetre wavelengths: Proceedings of the 22. Eslab Symposium, 15:49791 (RA;FR)
Tulegenov, M.Sh., K^--meson production in relativistic nuclear collisions and nuclear pionization model: 1. High energy physics and computer technique, 15:50044 (RA;SU;In Russian)
See Ameev, S.Sh., 15:50043, 15:50047
Tull, J.K., Thermal-neutron capture gamma-rays, 15:49987 (R;XA)
Tulk, J.D., *See* Zane, R.M., 15:48234
Tumanyan, R.V., On the possibility of oscillation damping in strong-focusing accelerator by spontaneous radiation, 15:49231 (R;SU;In Russian)
Tur, A.V., *See* Bolotov, V.N., 15:49879
Tura, M.A., *See* Majer, E.L., 15:48330
Turchanovich, L.K., *See* Buzulutskov, A.F., 15:49297
Turko, B.T., High speed imaging with a tapped solid state sensor, 15:49333 (J;US)
See Smith, R.C., 15:50246
Turner, E., *See* Easterling, J.B., 15:48363
Turner, J.L., *See* Beck, S.C., 15:49797
Turner, M.S., Periodic signatures for the detection of cosmic axions, 15:49819 (R;US)
See Burrows, A., 15:49824
See Harvey, J.A., 15:49820

See Kamionkowski, M., 15:49822
Twesme, E., *See* Arya, R.R., 15:48462
Tyler, S.W., *See* Hurst, T.L., 15:49592

U

Uber, D., *See* Haber, S.F., 15:49360
Uberoi, M., *See* Shadman, F., 15:48113
Uchiyama, Y., Technical assessment and economic study of compressed air energy storage in Japan, 15:48685 (R;JP;In Japanese)
Uckan, T., *See* Ritz, C.P., 15:50112
Udseth, H.R., *See* Smith, R.D., 15:49025
Uemoto, H., *See* Kikuchi, K., 15:49590
See Watanabe, Y., 15:49591
Uemura, Y.J., *See* Le, L.P., 15:48923
Ueng, T.S., *See* Ramirez, A.L., 15:48332
Ugarov, S.B., *See* Balabin, A.I., 15:49233
Uic, S., *See* Batchelor, K., 15:49225
Unruh, W.P., *See* Wolf, M.A., 15:49563
Unsworth, M.D., VANDAL technical overview: VANDAL version 1.1, 15:48267 (R;GB)
VANDAL user guide. V. 1.1: Input and execution (VANDAL version 1.1), 15:48264 (R;GB)
VANDAL user guide. V. 1.2: Input and execution appendices (VANDAL version 1.1), 15:48265 (R;GB)
VANDAL user guide. V. 2.1: Output and error messages (VANDAL version 1.1), 15:48266 (R;GB)
Upadhyaya, B.R., *See* Bywater, R.L., 15:48611
See Eryurek, E., 15:48616
Urata, Kazuhiro, Current bubble formation by nonlinear coupling of resistive tearing modes, 15:50163 (R;JP)
Urbatsch, T., *See* Imel, G.R., 15:48402
Urish, J., *See* Swoboda, C., 15:49336
Usenko, A.S., Equilibrium distributions in plasma-molecular systems with non-plane boundaries, 15:50154 (R;UA;In Russian)
See Zagorodnij, A.G., 15:50153
Ushimaru, Kenji, Japanese power electronics inverter technology and its impact on the American air conditioning industry, 15:48793 (R;US)
Usmen, R., *See* Celik, I., 15:48109
Uvarov, V.A., On energy dependence of the width and shape of the rapidity distribution of negatively charged particles, 15:49927 (R;SU;In Russian)

V

Vaclav, E., *See* Misak, J., 15:48559
Vagin, A.I., *See* Vatutin, V.M., 15:49378
Valentin, R.A., *See* Shin, Y.W., 15:48581
Valo, M., *See* Toerronen, K., 15:48521
Valovic, M., *See* Zacek, F., 15:49876
Van Berg, R., *See* Kononenko, W., 15:49358
van Dalen, A., Modified sulphur cement: A low porosity encapsulation material for low, medium and alpha waste, 15:48274 (R;FR)
Van Dam, J.W., *See* Kim, Jin-Yong, 15:50119
Van Den Avyle, M.J., *See* Hill, J., 15:49588
van den Berg, R., In-situ biorestoration of a subsoil contaminated with gasoline. Interim report, 15:48156 (R;NL)
van der Heijden, C.A., *See* Montizaan, G.K., 15:49722
Van der Schaaf, B., The function of the HFR, Petten, in the development of plasma facing components for fusion reactors, 15:50172 (RA;FR)
Van Der Sluys, L.S., Reactivity of metal dihydrogen complexes: Studies of Mo and W, 15:49092 (BA;US)
Van Der Sluys, W.G., Low temperature routes to uranium nitrides, 15:48219 (BA;US)
Van Dijk, C., Neutron scattering in solid state physics and materials science, 15:48625 (RA;FR)
Van Dyke, G., *See* Johnson, D., 15:49567
van Huisteyn, D.B., *See* Overton, W.C. Jr., 15:49385
Van Luik, A., *See* Alexander, D., 15:48355
Van Luik, A.E., *See* Daling, P.M., 15:48386
van Steenbergen, A., *See* Batchelor, K., 15:49225
Van Wyk, L., *See* Thompson, R.B., 15:48919
Vanberg, R., *See* Barsotti, E., 15:49274
Vandewalle, R.C., *See* Ward, C.R., 15:49175
Vane, C.R., *See* Claytor, N., 15:49916
See Dittner, P.F., 15:49917
Vanhoenacker, L., *See* Stubbe, E.J., 15:48556
Vanyushin, I.A., *See* Abdullin, S.K., 15:49997
Varnado, G.B., *See* Kjeldgaard, E.A., 15:48726
Vartanyan, G.S., *See* Balayan, Z.K., 15:49291
Vasey, A.R., *See* Hawke, R.S., 15:49167
Vasil'chenko, V.G., *See* Buzulutskov, A.F., 15:49297
Vasilevskij, V.S., *See* Ostashko, V.V., 15:50034
Vasilishin, B.V., *See* Balandikov, A.N., 15:49229
Vasseur, C., Bibliographic study specifying the limits of fire risk presented by uranium dioxide powder, 15:48375 (R;FR;In French)
Vatutin, V.M., Fiber-optical systems in physical experiment technique. Part 1: Part 1: Concepts and components, 15:49378 (R;SU;In Russian)
Vaughn, E., How renewable fuels contribute to clean air, 15:48440 (RA;CA)
Vaughn, R.L., Evaluation of room-temperature chloroaluminate molten salts as electrolytes for high energy density batteries. Final report, June 1988-April 1990, 15:48691 (R;US)
Veira, D.K., Spatially resolved Raman spectroscopy in the study of transformed zones in PSZ, 15:49077 (RA;US)
Unenhanced surface Raman spectroscopy of nitrogen physisorbed on Ag(111), 15:49076 (RA;US)
See Chia, V.K.F., 15:49282
Vejcik, S., *See* Yarema, R.J., 15:49371
Veklerov, E., The feasibility of images reconstructed with the method of sieves, 15:49702 (J;US)
Vellutini, D., *See* Bustin, R.M., 15:48126
Velsko, S.P., Strategy and tactics in the search for new harmonic generating crystals, 15:49094 (BA;US)
Venikov, N.I., *See* Ogloblin, A.A., 15:50017
Verbunt, F., *See* Vrtilek, S.D., 15:49837
Veresczinski, Z., Two-wavelength, multi-channel, submillimeter laser interferometer for measurements of plasma density in T-15 tokamak, 15:50135 (RA;CS;In Russian)
Vergnet, L., Development of charcoal making processes in France, 15:48424 (RA;LU)
Verheul, J.H.A.M., *See* van den Berg, R., 15:48156
Verhoeven, J.D., Production techniques for discontinuous filament A-15 superconductor wire, 15:48876 (R;US)
Verkade, J.G., ^{31}P NMR analysis of coal moieties bearing -OH, -NH and -SH functions: Quarterly report, April 1, 1990–June 30, 1990, 15:48086 (R;US)
Verkhoglyadova, O.P., Mutual coherent properties of the images of the quasar microlensed by star mass, 15:49816 (R;UA)
Verstraete, L., An implication of the IR identification of PAHs: the heating of the diffuse is gas: Proceedings of the 22. Eslab Symposium, 15:49774 (RA;FR)
See Leger, A., 15:49766
Veryutin, V.A., The development and tests of high-power Y-circulator of the metre-wave range, 15:49253 (R;SU;In Russian)
Vesely, V., *See* Dvoracek, J., 15:50149
Vetesnik, P., *See* Stoeckel, J., 15:50143
Vetrano, J.S., In-situ studies of ion irradiation effects in an electron microscope, 15:48985 (J;US)
Victor, P., *See* Sanger, T., 15:49470
Vierstra, R.D., Mechanism for the selective conjugation of ubiquitin to phytochrome: Progress report for 1989, 15:49643 (R;US)
Vieth, G., Sensitometric and densitometric methods for quality control of medical X-ray images: Tolerances, limiting values and appropriate measuring methods, 15:49686 (RA;GB)
Viitanen, M., *See* Lamminen, J., 15:48763
Viktorov, A.N., *See* Baranaev, Yu.D., 15:48582
Villanueva, C., Economics of the use of the Laguna Verde 2 initial core as reloads of Laguna Verde 1: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988, 15:48248 (RA;XA)
Vine, E., *See* Krause, F., 15:48784

Vineyard, E.A., *See* Conklin, J.C., 15:48773
Vinsot, A., Setting up and experimental validation of the coupling between a geochemical model and a transport model of dissolved elements, 15:48271 (R;FR;In French)
Visco, S.J., Sodium/beta″-alumina/organosulfur batteries operating at intermediate temperatures, 15:49112 (RA;US)
See Liu, M., 15:49113
Vishniac, E.T., *See* Ryu, D., 15:49838
Vissers, D.R., *See* Patil, P.G., 15:48838
Vladimirov, A.A., On the origin of the Schwinger anomaly, 15:49970 (R;SU)
Vlasov, V.P., Cosmic ray production in plasma z pinches, 15:49809 (R;SU;In Russian)
Voegele, M.D., *See* Blanchard, M.B., 15:48359
Voelk, H.J., The correlation between radio and far-infrared emission for disk galaxies: Proceedings of the 22. Eslab Symposium, 15:49808 (RA;FR)
Voelker, F., *See* Jacob, A.F., 15:49236
Vogel, L.W., A demonstration of the systems integration modeling system (SIMS) as a decision-support tool: Volume 1, 15:48328 (BA;US)
Systems integration operations/logistics model (SOLMOD): Volume 1, 15:48365 (BA;US)
Vogt, L.J., *See* Willis, H.L., 15:48749
Volkman, Y., On the removal of mercury from flue-gas scrub solutions by cementation, 15:48096 (R;DE)
Volkov, B.E., *See* Fil, N.S., 15:48554
Volkov, E.D., *See* Arsen'ev, A.V., 15:50160
Volkov, G.G., *See* Amaglobeli, A.N., 15:49931
Volkov, V.I., *See* Balandikov, A.N., 15:49229
Volkov, V.V., Methods of superchronous processing of signals in high-temperature plasma diagnostics, 15:50127 (R;SU;In Russian)
Volkov, Ya.F., Study on the atom beams and plasma production at the materials evaporation by laser radiation, 15:50158 (R;UA;In Russian)
Volkow, N.D., *See* Dilmanian, F.A., 15:49346
Vollhardt, C., *See* Peter, K., 15:49052
Vollhardt, K.P.C., *See* Huffman, M.A., 15:49054
See Kerby, M.C., 15:49055
See Newman, D.A., 15:49053
Volski, J., Neutron spectrometers for the T-15 tokamak, 15:49302 (RA;CS;In Russian)
Von Zanthier, C., Initial performance of the wire imaging synchrotron radiation detector, 15:49268 (J;US)
See Kent, J., 15:49322
See Rouse, F., 15:49272
Vong, R.J., *See* Sisterson, D.L., 15:49457
Vorbach, J., *See* Kinch, R., 15:48146, 15:49513
Vorob'eva, V.P., Analytical representation of the geometry of helical windings for plasma devices, 15:50179 (R;UA;In Russian)
Voslkovsky, O., Pressure history of a gas pipeline, 15:48189 (R;CA)
Voss, B., *See* Gaimard, J.J., 15:50006
Voss, C.F., A proposed methodology for validating performance assessment models for the DOE Office of Civilian Radioactive Waste Management Program: Volume 1, 15:48318 (BA;US)
An investigation of the mechanical and hydrologic behavior of tuff fractures under saturated conditions: Volume 1, 15:48337 (BA;US)
Vrakking, M.J.J., *See* Trickl, T., 15:49886
Vreeland, R.H., *See* Brush, L.H., 15:48288
Vrtilek, S.D., Observations of Cygnus X-2 with IUE: Ultraviolet results from a multiwavelength campaign, 15:49837 (B;DE)
Vuorisalo, J., *See* Lamminen, J., 15:48763
Vyrenkova, M.Ya., *See* Akopyan, V.P., 15:49246
Vyzgal, J., *See* Volski, J., 15:49302

W

Wadkins, R.P., *See* Oh, C.H., 15:49154
Wajnberg, E., *See* Linhares, M.P., 15:50067
Wakabayashi, S., *See* Yasuda, I., 15:48245
Wakaizumi, Seiichi, CP violating decay of neutral B meson, 15:49960 (RA;JP;In Japanese)
Wali, K.C., *See* Balachandran, A.P., 15:49899
Walker, A., *See* Parker, R.J., 15:48198
Walker, D.D., Soluble high-level waste decontamination and disposal at the Savannah River Site: Volume 1, 15:48352 (BA;US)
Walker, D.G., Proceedings of the conference Reclamation, a global perspective: Volume 1, 15:49413 (R;CA)
Proceedings of the conference Reclamation, a global perspective: Volume 2, 15:49414 (R;CA)
Walker, G.H., *See* Williams, M.D., 15:48467
Walker, K.P., *See* Freed, A.D., 15:48852
Walker, R.E., *See* Klem, M.D., 15:49193
Walker, W.L., Fabrication of axial stress corrosion cracks in Alloy 182 weld materials: Final report, 15:48529 (R;US)
Waller, H., The application of state observers in structural dynamics, 15:48488 (RA;DE)
Wallin, K., *See* Toerronen, K., 15:48521
Wallis, M.K., *See* Wickramasinghe, N.C., 15:49758
Walsh, D., *See* Swoboda, C., 15:49336
Walter, M.B., *See* Droppo, J.G. Jr., 15:49547, 15:49548, 15:49583
Wang, B.Q., The erosion-corrosion of modified chromium steels, 15:48119 (RA;US)
Wang, J.M., *See* Murphy, J.B., 15:49275
Wang, M., *See* Iwanczyk, J.S., 15:49325
Wang, N., *See* Shutt, T., 15:49344
Wang, O.S., N reactor external events probabilistic risk assessment using NUREG-1150 methods, 15:48669 (R;US)
Ward, C.R., Examples of robots and teleoperators at the Savannah River Site, 15:49175 (J;US)
Ward, M.J., *See* Espey, B.R., 15:49799
Ware, A.S., *See* Ritz, C.P., 15:50112
Warmack, R.J., *See* Ferrell, T.L., 15:49377
Warshel, A., Computer simulation of chemical reactions in synthetic model compounds and genetically engineered active sites. Final report, 1 July 1989-30 June 1990, 15:49641 (R;US)
Wasserman, H.J., *See* Simmons, M.L., 15:50224
Wasserman, P., Infrared flash kinetic spectroscopy of transients generated by irradiation of $(\eta^5\text{-}C_5H_5)Co(CO)_2$ in the gas phase and in solution, 15:49003 (RA;US)
Watanabe, Hiroshi, *See* Sjarief, S.H., 15:49714
Watanabe, Katsutoshi, Effects of environment and aging on creep properties of Alloy 800H, 15:48882 (R;JP;In Japanese)
Watanabe, Kazuya, Correlation function of gravitational deflection angles of light paths, 15:50105 (R;JP)
Watanabe, M., *See* Dilmanian, F.A., 15:49346
Watanabe, Y., Development of water purification technologies for intensive fish culture. 3.: Selection of marine denitrifying bacteria by their denitrification pattern, 15:49591 (R;JP;In Japanese)
Watson, S., *See* Kent, J., 15:49322
See Von Zanthier, C., 15:49268
Watts, C., *See* Sprott, J.C., 15:50115
Watwood, D., *See* Ramirez, A.L., 15:48332
Wawner, F.E., Investigation of thermo-mechanical effects in silicon carbide whisker/Al alloy composites. Final report, 1 March 1985-31 August 1989, 15:48902 (R;US)
Weaver, M.J., Dynamical solvent effects on electron-transfer processes: Recent progress and perspectives. Technical report, 15:49030 (R;US)
See Kuznetsov, A.M., 15:49031
Weber, D.A., *See* Dilmanian, F.A., 15:49346
Weed, H.C., *See* Nguyen, Son N., 15:49560
Weerasuiya, Y., *See* Norby, R.J., 15:49726
Weier, D.R., Statistical calibration and periodic performance checks for segmented gamma scanning, 15:48393 (R;US)
Weil, B.S., *See* Bradley, E.C., 15:48579
Weinberg, I., New directions in InP solar cell research, 15:48459 (R;US)
Weisenberger, A.G., *See* Haskins, P.S., 15:49362
Weiss, M.S., *See* Bonche, P., 15:50013
Weiss, M.T., *See* D'Agostino, P.A., 15:49409
Weiss, P.S., Polarization effects in reactive scattering of Na atoms in the 4D level, 15:49885 (RA;US)
The reactions of ground- and excited-state sodium atoms with hydrogen halide molecules, 15:49138 (RA;US)
Weiss, S., *See* Parsons, A., 15:49345

Weissenberg, T., *See* Kussmaul, K., 15:48605
Weissman, S.J., *See* Ashby, M.R., 15:50240
Wellman, G.W., *See* Hawke, R.S., 15:49167
Wemple, R.P., Recent field trials of directional boring equipment for emplacing a borehole grid around and beneath a simulated waste site, 15:49742 (R;US)
Wendt, J.O.L., *See* Shadman, F., 15:48112, 15:48113
Wendt, J.R., *See* Fritz, I.J., 15:48974
See Jones, E.D., 15:48976
Wentz, C.A., *See* Peters, R.W., 15:48091
Wentzcovitch, R.M., *See* Knittle, E., 15:49079
Wernette, D.R., *See* Nieves, L.A., 15:48255
Werveiman, R., *See* Abrahams, K., 15:48624
Wesling, J.R., *See* Gibson, J.D., 15:48309
Wesselborg, C., *See* Brenner, D.S., 15:50021
West, A.C., Current distribution near an electrode edge as a primary distribution is approached, 15:49116 (RA;US)
Westaway, K.C, The determination of the levels of dinitropyrenes on diesel exhaust particulate exhibiting excess mutagenic activity: Final report, 15:48841 (R;CA)
Westaway, K.C., Determination of the levels of dinitropyrenes on diesel-exhaust particulate exhibiting excess mutagenic activity, 15:48123 (R;CA)
Wester, W., *See* Wong, M., 15:49270
See Yarema, R.J., 15:49371
Wester, W.C., *See* Haber, C., 15:49273
Westerman, R.E., *See* Brush, L.H., 15:48288
Westmacott, K.H., *See* Dahmen, U., 15:48888, 15:48929, 15:49080
Westwood, H.J, Metallurgical investigation of main steam line weldment cracking, Lakeview TGS [thermal generating station], 15:48494 (R;CA)
Westwood, H.J., Metallurgical investigation of main-steam-line weldment cracking, Lakeview TGS, 15:48493 (R;CA)
Wheelock, T.D., *See* Drzymala, J., 15:48088
Whelan, G., *See* Droppo, J.G. Jr., 15:49547, 15:49548, 15:49583
Whitaker, J.S., *See* Cavalli-Sforza, M., 15:49359
White, C.W., *See* Xia, W., 15:48951
White, G.J., *See* Williams, P.G., 15:49792
White, K.L., *See* Kimber, C.T., 15:49569
White, T.S., Evaluation of emission factors for formaldehyde from certain wood processing operations. Final report, May-August 1989, 15:49543 (R;US)
Whitney, G.M., Microscopic resolution of mass-transfer enhancement at vertical gas-evolving electrodes, 15:49102 (RA;US)
Whittaker, B., *See* Edelstein, N., 15:49019
Whitten, W.B., *See* Ramsey, J.M., 15:49872
Wickramasinghe, N.C., Interpretation of the 10 μ m and 20 μ m absorption bands in comets, the ism and in an external galaxy: Proceedings of the 22. Eslab Symposium, 15:49758 (RA;FR)
See Hoyle, F., 15:49757, 15:49800
Wicks, G.G., MITT; International in-situ testing of simulated HLW forms: Preliminary analysis of SRL 165/TDS waste glass and metal systems: Volume 1, 15:48319 (BA;US)
Wiedeman, S., *See* Arya, R.R., 15:48462
Wiedersich, H., The effect of defect clusters formed in cascades on the sink strength in irradiated materials, 15:48863 (R;US)
Wiggins, S., *See* Kaper, T.J., 15:49898
Wilhite, E.L., *See* Walker, D.D., 15:48352
Wilke, N., *See* Galmiche, D., 15:50166
Wilkerson, J., *See* Parsons, A., 15:49345
Wilkerson, M.H., *See* Williams, J.M., 15:49096
Wilkey, P.L., *See* Levich, R.A., 15:48334
Wilkinson, D.H., Superallowed Fermi beta-decay: Applications, 15:50051 (R;CA)
Wille, L.T., *See* Burmester, C.P., 15:48932
Willetts, D.V., Pulsed-discharge carbon dioxide lasers, 15:49211 (RA;US)
Williams, C., *See* Zemb, T., 15:49284
Williams, D.A., *See* Cavalli-Sforza, M., 15:49359
Williams, G.M., Anomalously small 4f-5d oscillator strengths and 4f-4f electronic Raman scattering cross sections for Ce^{3+} in crystals of $LuPO_4$, 15:49022 (RA;US)
Intensities of electronic Raman scattering between crystal-field levels of Ce^{3+} in $LuPO_4$: Nonresonant and near resonant excitation, 15:49023 (RA;US)
Williams, J.M., Emulsion stability and rigid foams from styrene or divinylbenzene water-in-oil emulsions, 15:49096 (J;US)
Williams, J.R., Defining the need for and functions of the monitored retrievable storage (MRS) facility: Volume 1, 15:48327 (BA;US)
See Danker, W.J., 15:48367
Williams, M.C., *See* Wise, J., 15:49370
Williams, M.D., Diode laser satellite systems for beamed power transmission, 15:48467 (R;US)
Williams, P.G., JCMT observations of the circumstellar envelope IRC + 10216: Proceedings of the 22. Eslab Symposium, 15:49792 (RA;FR)
Williams, R.R., *See* Barkman, W.E., 15:49169
Williams, T., *See* Forsey, C.D., 15:48243
Williams, W.G., ISIS status and prospects, November 1989, 15:49263 (RA;JP)
Williamson, K., *See* Wood, D.S., 15:48871
Willis, H.L., DSM [Demand-Side-Management]: Transmission and distribution impacts: Volume 2, Application on spatial frequency analysis: Final report, 15:48749 (R;US)
Willis, M.G., Magnetohydrodynamic modification of the TEACH-T code and the prediction of the maximum azimuthal velocity in a conducting fluid, 15:49896 (R;US)
Willis, R.R., *See* Moyer, B.A., 15:49088
Willman, A.J., State-of-the-art interior-piping-systems applications: Commercial buildings. Final report, June 1987-June 1989, 15:48792 (R;US)
Wilson, C.N., Effects of water composition on the dissolution rate of UO_2 under oxidizing conditions: Volume 1, 15:48220 (BA;US)
Wilson, D.L., Conditional climatology of Ap: The relationship between solar flares and geomagnetic storms, 15:49851 (R;US)
Wilson, J.W., Improved model for solar cosmic ray exposure in manned Earth orbital flights, 15:49716 (R;US)
Wilson, R.B., *See* Tong, G.T., 15:48075
Wilson, R.J., *See* Cavalli-Sforza, M., 15:49359
Wilson, T.L. Jr., *See* Wood, R.T., 15:48617
Winden, J.V., *See* Ang, T.G., 15:48458
Winkelmann, F., *See* Augenbroe, G, 15:48783
Winkelmann, H.P., *See* Chung, F., 15:49431
Winkler, J.R., *See* Zhang, X., 15:49095
Winschel, R.A., Stable carbon isotope analysis of coprocessing materials: Quarterly technical progress report, July 1–September 30, 1989, 15:48076 (R;US)
Winter, B.J., Chemical identification of icosahedral structure for cobalt and nickel clusters, 15:48865 (R;US)
Wise, J., Study of plasma chemistry in wire chambers by GC/MS, 15:49370 (J;US)
Wishart, J.F., *See* Ogawa, M.Y., 15:49648
Witkowski, W.R., *See* Blacker, T.D., 15:50241
Witt, C.R., *See* Golliher, K.G., 15:49165
Wolttlez, J.R.W., Application of reactor neutrons for activation analysis, 15:48626 (RA;FR)
Wojcik, R., *See* Zorn, C., 15:49369
Wolf, D., *See* Rickman, J.M., 15:48860
Wolf, M., Low-level tritium measurements in groundwater samples from Stripa-Pluton (Sweden), 15:49598 (RA;DE;In German)
Wolf, M.A., New method permits the detection of alpha emitters at a distance, 15:49563 (J;US)
Wolf, S.A., *See* Kihlstrom, K.E., 15:48889
See Kresin, V.Z., 15:49122
Wolfe, B.A., *See* Smith, R.A., 15:48340
Wolfrum, C., Investigations on the diffusion of inorganic pollutants in selected sediments from the Asse cap rock and in clay samples from the Niederwallach landfill, 15:49459 (RA;DE;In German)
See Lang, H., 15:49596
Wolfs, F.L.H., *See* Khoo, T.L., 15:50011
Womersley, J., CAD tools for detector design, 15:49293 (R;US)
Wong, J., X-ray absorption spectroscopic study of vanadium sites in fossil fuels and model compounds, 15:48090 (BA;US)
Wong, M., Use of fiber-optics for real-time control and data acquisition, 15:49270 (J;US)
See Haber, C., 15:49273

Wong, R.K.W., Towards a strategy for adapting to climate change in Alberta, 15:49455 (R;CA)
Wood, D.S., Extrapolation of stress rupture data on 9 to 12% Cr steels, 15:48871 (R;FR)
Wood, G.M., *See* Klein, V.F., 15:49367
Wood, R.T., Inherent reactor power controller for a metal-fueled ALMR, 15:48617 (J;US)
Wood, T.W., Spent fuel storage requirements for nuclear utilities and OCRWM: Volume 1, 15:48345 (BA;US)
Woodle, M., *See* Batchelor, K., 15:49225
Woods, B.G, Infrasonic enhancement of heat transfer: Preliminary report, 15:49186 (R;CA)
Woods, H.J., *See* Bruijn, T.J.W. de, 15:48195
Woodside, J., *See* Baer, H., 15:49907
Woodward, J., The effect of denaturation and reduction on cellobiohydrolase 1 from Trichoderma reesei, 15:49642 (R;US)
Woodwell, G.M., The effects of a rapid global warming: Garden of eden or global impoverishment?, 15:49432 (RA;US)
Woody, C.L., Readout techniques and radiation damage of undoped cesium iodide, 15:48940 (J;US)
Woosley, S.E., The great supernova of 1987: Volume 571, 15:49840 (BA;US)
See Howard, W.M., 15:49836
Wootton, A.J., *See* Ritz, C.P., 15:50112
Worden, E.F., *See* Blaise, J., 15:49021
Workman, A., A review of automatic exposure control of conventional and digital systems: Tolerances, limiting values and appropriate measuring methods, 15:49672 (RA;GB)
Worl, L.A., Light induced processes of MLCT [metal to ligand charge transfer] excited states attached to a soluble polymer, 15:49143 (BA;US)
Worley, P.H., Modeling histogram data with piecewise polynomials, 15:50237 (R;US)
Wormington, P.S., *See* Halbleib, L.L., 15:48977
Worsoee-Schmidt, P., Multi-stage solid absorption heat transformers for recovery of industrial waste heat: Final report, 15:48810 (R;LU)
Worswick, D., The MERLIN programme: Pt. 2, A description of the MERLIN rig, 15:48662 (R;GB)
Wosiek, J., *See* Haymaker, R.W., 15:49924
Woychik, R.P., *See* Brown, G.M., 15:49647
Wozniak, G.J., *See* Moretto, L.G., 15:50001
Wray, J., *See* Payne, M.G., 15:49871
Wright, A.E., Fast reactor safety testing in Transient Reactor Test (TREAT) in the 1980s, 15:48640 (R;US)
Wright, B, Weld process development for fabrication of heavy wall pressure vessel: Part 3, 15:48858 (R;CA)
Wright, G.S., *See* Doyon, R., 15:49798
Wright, J., Diffusion coefficients and hydraulic conductivity in unsaturated Hanford soils and sediments: Volume 1, 15:48336 (BA;US)
Wu Deming, *See* Liu Qiaosheng, 15:48251
Wu, A.H., Extraction of fatty-acid methyl esters with supercritical carbon dioxide, 15:49070 (RA;US)
Wu, J.L., Design and testing of a high temperature superconducting current lead, 15:49205 (R;US)
Wuebbles, D., *See* Edmonds, J., 15:49420
Wulff, W., *See* Rohatgi, U.S., 15:48664
Wunderlich, B., Analysis and prediction of thermal properties of mesophases and crystals by calorimetry and supercomputers, 15:48953 (R;US)

X

Xia, W., Ion mixing of semiconductor superlattices, 15:48951 (R;US)

Y

Yagi, K., *See* Nishino, T., 15:49215
Yahata, Taneaki, Volume reduction of ion exchange resins by catalytic incineration, 3: Investigation of overall reaction rate, 15:48283 (R;JP;In Japanese)
Yakimenko, I.P., *See* Golubinskij, P.K., 15:50152
See Gvozdetskij, V.S., 15:50151
Yakobi, V.V., *See* Boos, E.G., 15:49992
Yamaguchi, K., *See* Maki, N., 15:49214
Yamamoto, Hisashi, Magnetic properties of Hubbard-sigma model with three-dimensionality, 15:48917 (R;JP)
Yamamoto, Tadatoshi, *See* Ogawa, Hiromichi, 15:49572
Yamamoto, Yoichi, Automatic remote communication system: Development of the upgraded RECOVER system, 15:48392 (R;JP;In Japanese)
Yamamoto, Yoshifumi, *See* Sakata, Fumihiko, 15:50031
Yamamura, Yasunori, Data compilation of angular distributions of sputtered atoms, 15:50087 (R;JP)
Yamashita, T., *See* Puxley, P., 15:49806
Yamazaki, T., *See* Kadono, R., 15:50029
Yamazaki, Toshimitsu, Real-pion states formed by virtual-pion beam: New family of nuclear excited states, 15:49996 (R;JP)
See Komori, Fumio, 15:50072
Yan'kov, V.V., *See* Filippov, D.V., 15:50122
Yan, X.H., *See* Singh, M., 15:49363
Yang, C.H., Thermal analysis of heat-pipe radiators with a rectangular groove wick structure. Master's thesis, 15:49159 (R;US)
Yang, J.Z., Thermodynamics of electrolyte mixtures. Activity and osmotic coefficients consistent with the higher-order limiting law for symmetrical mixing, 15:49044 (RA;US)
Yang, L., *See* Arya, R.R., 15:48462
Yanovskij, V.V., *See* Bolotov, V.N., 15:49879
Yarema, R., *See* Swoboda, C., 15:49336
Yarema, R.J., A high speed, high gain preamplifier system for silicon strip detectors, 15:49340 (J;US)
Radiation effects on the SVX silicon strip readout chip, 15:49371 (J;US)
See Haber, C., 15:49273
Yasillo, N.J., Design considerations for a single tube gamma camera, 15:49348 (J;US)
Yasnogorodskij, A.M., *See* Ostashko, V.V., 15:50034
Yasu, Yoshiji, Advanced computer program (ACP) at KEK, 15:50223 (RA;JP)
Yasuda, I., Economic aspects of the PNC process: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988, 15:48245 (RA;XA)
Yasue, Masaki, Extra weak bosons in a confining gauge theory with complementarity, 15:49938 (R;JP)
Yasukawa, Shigeru, *See* Takeda, Takeshi, 15:48576
Yatskiv, Ya.S., *See* Kamenskij, K.K., 15:49812
Yayashi, T., *See* Terminello, L.J., 15:48963
Ye, D., *See* Khoo, T.L., 15:50011
Yee, C., *See* Dilmanian, F.A., 15:49346
Yew, P.C., *See* Fang, Z., 15:50247
Yokoyama, A., *See* Zhao, X., 15:49141
Yonomoto, Taisuke, *See* Suzuki, Mitsuhiro, 15:48656
Yoo, M.H., [Defects in close-packed metals and alloys]: Foreign trip report, August 9, 1990–August 22, 1990, 15:48896 (R;US)
Yoon, R.H., In-plant testing of microbubble column flotation: Technical progress report second quarter, January 1, 1990–March 31, 1990, 15:48072 (R;US)
Yorkey, T., X-ray holography for sequencing DNA, 15:49652 (R;US)
Yoshida, Kiyoshi, *See* Konno, Masayuki, 15:49279
Yoshimoto, Yasuhiko, Frequency of malignant tumors during the first two decades of life in the offspring (F_1) of atomic bomb survivors, 15:49717 (R;JP)
Yoshinaga, N., *See* Menezes, D.P., 15:49964
You, H., *See* Chang, H.L.M., 15:48915
Younathan, J., *See* Worl, L.A., 15:49143
Young, A.T., *See* Darwin, D.C., 15:49039
Young, J.P., Applications of diode lasers to resonance ionization mass spectrometry, 15:49870 (R;US)
Young, K.A., *See* Armstrong, T.R., 15:48945
Young, M.A., *See* Last, G.V., 15:49741
Young, P.G., General purpose nuclear data evaluations for ENDF/B-VI: Impact of cross-section standards, 15:49993 (R;US)
Youngdahl, C.A., *See* Wu, J.L., 15:49205
Youngren, M.A., Nuclear-effects model embedded stochastically in simulation (NEMESIS) summary report. Technical paper, 15:49404 (R;US)

Younker, J., *See* Alexander, D., 15:48355
Younker, J.L., *See* Blanchard, M.B., 15:48359
Younkin, W., *See* Martens, H., 15:48163
Yu Erjun, Applications of safety analysis codes at the Institute of Atomic Energy, Beijing: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48547 (RA;XA)
Yu, B., SSC detector R&D at Brookhaven National Laboratory (BNL): April 1990 Status report, 15:49283 (R;US)
See Debbe, R., 15:49323
See Fischer, J., 15:49267
Yu, P.K.L., *See* Xia, W., 15:48951
Yu, P.Y., *See* Cohen, M.L., 15:50086
See Goldstein, H.F., 15:48927
Yu, S.S., *See* Shay, H.D., 15:49238
Yueh Cheun Ho, P., *See* Edmonds, J., 15:49424
Yueh Chuen Ho, P., Malaysia's response to global climate change, 15:49445 (RA;US)
Yuldashev, M.M., *See* Fajn, V.Eh., 15:50058
Yuracko, K.L., Transporting spent nuclear fuel: A framework for decision-making, 15:48232 (R;US)
Yushkov, A.V., Detection and experimental investigation of α-particle Wolf-Bragg scattering on quasicrystalline atomic nuclei, 15:49990 (R;SU;In Russian)

Z

Zabela, A.G., Integral equations for elastic wave scattering on non-uniformities in anisotropic media, 15:49235 (R;UA;In Russian)
Zacek, F., A 40 keV neutral lithium beam source for tokamak CASTOR, 15:49876 (RA;CS)
See Dvoracek, J., 15:50149
See Stoeckel, J., 15:50143
Zagorodnij, A.G., Electromagnetic wave incoherent reflection by a plasma layer, 15:50153 (R;UA;In Russian)
See Golubinskij, P.K., 15:50152
See Gvozdetskij, V.S., 15:50151
Zagryadskij, V.A., *See* Borisov, A.A., 15:50056
Zahn, L.L., *See* Michels, L.R., 15:48225
Zahn, M.T., Investigation in the propagation of mercury in groundwater of quaternary gravels, 15:49595 (RA;DE;In German)
Zajtsev, F.S., *See* Dvornikova, N.A., 15:50128
Zakharov, S.V., *See* Gasilov, V.A., 15:50124
Zalkin, A., Bis(bis(pentamethylcyclopentadienyl)Ytterbium(III)) ditelluride, 15:49015 (RA;US)
Bis(bis(trimethylsilyl)cyclopentadienyl) (chloro)uranium(III)bis (trimethylsilylcyanide), 15:49013 (RA;US)
Bis[(bis(trimethylsilyl)cyclopentadienyl]-chloro)uranium(III) bis (2,6-dimethylphenylisocyanide), 15:49011 (RA;US)
Bis[bis(t-butyl)cyclopentadienyl]uranium chloride, 15:49010 (RA;US)
Di-μ-oxo-bis(bis(bis(trimethylsilyl)cyclopentadienyl)uranium(IV)), 15:49009 (RA;US)
Structure of rubidium uranyl(VI) trinitrate, 15:49014 (RA;US)
Tris[bis(trimethylsilyl)amido](trimethylsilylimido)uranium(V), 15:49008 (RA;US)
See Berg, D.J., 15:49018
See Beshouri, S.M., 15:49007, 15:49012
See Edelstein, N.M., 15:49004
See Rosen, R.K., 15:49060
See Stults, S.D., 15:49006
Zane, R.M., Scale-model simulation of impact of a rail-locomotive coupler on the irradiated-fuel transportation cask, 15:48234 (R;CA)
Zangrando, F., *See* Bharathan, D., 15:48471
Zarimpas, N., *See* Raes, F., 15:48648
Zarubin, A.B., *See* Bobylev, A.V., 15:49258
Zaruchejskij, V.G., Digital Hall magnetometer, 15:49383 (R;SU;In Russian)
Zarzycki, J., *See* Craievich, A.F., 15:48909
Zastrozhnova, N.N., *See* Boos, E.G., 15:49992
Zaveryaev, V.S., Project of CFP plasma diagnostic system for the T-15 tokamak, 15:50144 (RA;CS;In Russian)
Zavgorodnij, S.F., Calculation of energy release depth distributions for electrons with 5-100 MeV energy in thick targets: 2. Solid state physics and mass transfer simulation, 15:50057 (RA;SU;In Russian)
Zavorshy, S.J., *See* Ma, C.W., 15:48374
Zayatdinov, R.M., Study on centrifugal acceleration of hydrogen pellets, 15:50175 (R;SU;In Russian)
Zayhowski, J.J., Limits imposed by spatial hole burning on the single-mode operation of standing-wave laser cavities, 15:49202 (R;US)
Zdankiewicz, M., Activities in the field of nuclear power engineering in Poland: Summary report, 15:48564 (RA;XA)
Zeevaart, J.A.D., *See* Gage, D.A., 15:49650
Zegers, P., Absorption heat pumps: Proceedings of a workshop, 15:48807 (R;LU)
Zelinski, B., *See* Borowecki, M., 15:50142
See Siedzinski, S., 15:50139
Zemb, T., Proposal of a crossed Bonse-Hart type camera at E.S.R.F. for very high resolution X-Ray diffraction and very low angle scattering, 15:49284 (R;FR;In French)
Zemskov, E.A., To the problem of optimization of external and integral iteration algorithm in diffusion calculation of nuclear reactor, 15:48594 (R;SU;In Russian)
Zemva, B., A general method for the synthesis of polymeric binary fluorides exemplified by AgF_3, NiF_4, RuF_4, and OsF_4, 15:49099 (RA;US)
Zenkevich, P.R., Increase of strip beam emittance in linear focusing systems, 15:49234 (R;SU;In Russian)
Zentner, M.D., *See* Wang, O.S., 15:48669
Zetti, A., *See* Goldstein, H.F., 15:48927
Zhang, J.Y., *See* Brenner, D.S., 15:50021
Zhang, R.S, *See* Batchelor, K., 15:49225
Zhang, S.B., Quasiparticle calculation of valence-band offset of AlAs-GaAs(001), 15:50085 (RA;US)
Zhang, X., Solvent and temperature dependence of the luminescence properties of binuclear metal complexes, 15:49095 (BA;US)
See McCarley, R.E., 15:48937
Zhang, X.S., *See* Leung, K.T., 15:48962, 15:49134
See Terminello, L.J., 15:48963
Zhang, Y., *See* Bazin, D., 15:50003
Zhao, X., Dissociation of cyclohexene and 1,4-cyclohexadiene in a molecular beam, 15:49141 (RA;US)
Zhdanov, S.K., *See* Vlasov, V.P., 15:49809
Zheng, C., *See* Heben, M.J., 15:48454
Zheng, Y., *See* Dabrowski, B., 15:48910
Zhidkov, E.P., Solution of eigenvalue problem for one class of hypersingular quasipotential integral equations, 15:50101 (R;SU;In Russian)
Zhmajlo, S.A., Local facility control organization in distributed automated control systems of technological parameters, 15:48610 (R;SU;In Russian)
Zhogolev, V.E., *See* Zaveryaev, V.S., 15:50144
Zhongping, Zhu, *See* Chiang, Shan-Hsin, 15:49436
Zhou, Z., *See* Dayal, R., 15:48285
Zhu, B., *See* Xia, W., 15:48951
Zhu, C.Q., *See* Fang, Z., 15:50247
Zhu, D.H., Complexation of lanthanide(III) ions by catechol and similar ligands, 15:49059 (RA;US)
Zijp, W.L., The HFR as research tool. Operation, maintenance and upgrading, 15:48623 (RA;FR)
Zimmer, A., *See* Falci, F.P., 15:49171
Zimmerman, R.W., Combined analytical/numerical approaches to solving fluid flow problems in the unsaturated zone at Yucca Mountain: Volume 1, 15:48338 (BA;US)
Zimmerman, T., A high speed, low noise ASIC preamplifier for silicon strip detectors, 15:49343 (J;US)
See Haber, C., 15:49273
See Swoboda, C., 15:49336
See Yarema, R.J., 15:49340, 15:49371
Zindler, A., *See* Bard, E., 15:49029
Zingg, S.P., Enhanced photooxidation of anthracene on SiO_2, 15:49144 (BA;US)
Zink, J.A., Analysis of the morality of intention in nuclear deterrence, with special reference to final retaliation. Doctoral thesis, 15:48846 (R;US)
Zlock, H.J., Measurement of proton induced radiation damage to CMOS transistors and PIN diodes, 15:49374 (J;US)

Zipperian, T.E., *See* Fritz, I.J., 15:48974
See Hughes, R.C., 15:48980
See Jones, E.D., 15:48976

Zlatanov, Z., An impact parameter analysis of antiproton-proton elastic and inelastic scattering at 22.4 GeV/c, 15:49950 (R;SU;In Russian)

Zmeskal, J., Experimental investigation of muon-catalysed fusion in pure deuterium: current status and future possibilities, 15:50183 (RA;GB)

Znojil, M., Two new types of solvability of the one-dimensional anharmonic oscillators, 15:49971 (R;SU)

Zocher, R.W., *See* Johnson, E.W., 15:48408

Zorin, O.L., *See* Batunin, A.V., 15:49932

Zorn, C., Preliminary study of radiation damage in liquid scintillators, 15:49369 (J;US)
Studies in the radiation resistance of plastic scintillators: Review and prospects, 15:49373 (J;US)
See Hertzog, D.W., 15:49286

Zorn, M., *See* Hertzog, D.W., 15:49286

Zucchelli, P., *See* Cavalli-Sforza, M., 15:49359

Zumberge, M.A., *See* Ander, M.E., 15:50107

Zwahlen, E.D., A gas-flow source term from a nuclear waste container in an unsaturated medium: Volume 1, 15:48380 (BA;US)

Zyvoloski, G., *See* Kelkar, S., 15:48342

Subject Index

This index is arranged by subject descriptors selected from those assigned to each citation in this publication. Subject descriptors are selected from a controlled thesaurus of terms, *International Energy: Subject Thesaurus* (ETDE/PUB-2). In order to enhance indexing, subject descriptor entries generally consist of a pair of descriptors: a main term and a qualifier term. Each entry includes the full title (which may be followed by supplementary descriptive information in parentheses) and the citation number. Additional information given in parentheses indicates the document type (an abbreviation such as B for book), the country of publication (such as DE for Federal Republic of Germany), and the language if non-English.

See references guide users from synonymous terms to the descriptors selected for the concept. *See also* references indicate subject concepts that are more specific than a particular descriptor. To gain complete subject coverage, all such terms should be reviewed.

A

A RESONANCES
See MESONS

A-BOMB SURVIVORS
Frequency of malignant tumors during the first two decades of life in the offspring (F_1) of atomic bomb survivors, 15:49717 (R;JP)

A2H-1320 RESONANCES
See MESONS

A2L-1280 RESONANCES
See MESONS

ABANDONED SITES
Results of the radiological survey at the Granite City Steel faciltiy, Granite City, Illinois, 15:49575 (R;US)
Waste management aspects of the Formerly Utilized Sites Remedial Action Program, 15:48258 (R;US)

ABNORMALITIES (CHROMOSOMAL)
See CHROMOSOMAL ABERRATIONS

ABSCISIC ACID
Abscisic acid biosynthesis in isolated embryos of Zea mays L., 15:49650 (J;US)

ACCELERATOR FACILITIES
See also STANFORD LINEAR COLLIDER
Experimental area design for operation at high intensities, 15:49265 (R;CA)

ACCELERATORS
See also CYCLIC ACCELERATORS
ELECTROSTATIC ACCELERATORS
LINEAR ACCELERATORS
RAILGUN ACCELERATORS
Advanced accelerator concepts, 15:49226 (B;US)
Experimental study of the plasma-focus device as a charged-particle accelerator. Final report, October 1982-May 1985, 15:49223 (R;US)

ACCIDENTAL INTAKE
See ACCIDENTS

ACCIDENTS
See also REACTOR ACCIDENTS
EE Microfabrication facility toxic gas system: A probabilistic risk assessment using human reliability analysis methods, 15:49731 (R;US)

ACES
See QUARKS

ACETIC ACID
Anaerobic fluid-bed treatment of coal conversion wastewater: Tenth quarterly technical progress report, November 15, 1988–February 15, 1988, 15:48093 (R;US)

ACID RAIN
An integrated acid precipitation policy and energy market model, 15:48097 (R;US)
Formation of oxyacids of sulfur from SO_2, 15:49051 (RA;US)
Impact of acidification on the economic value of recreational fishing in eastern Canada. Economic and Commercial Analysis Report No. 14, 15:49600 (R;CA)
Members committee report: Critical point one, 15:49465 (R;CA)
Modeled sulfur deposition trends since 1990 in North America, 15:49456 (R;US)

ACIDITY
See PH VALUE

ACOUSTIC EMISSION TESTING
Anecdotal history of acoustic emission from wood, 15:50104 (R;US)
Classification of acoustic emission waveforms for nondestructive evaluation using neural networks, 15:50239 (R;US)

ACRYLONITRILE
Final best demonstrated available technology (BDAT) background document addendum for acrylonitrile wastes (K011, K013, and K014). Volume 15, 15:49489 (R;US)
Final response to BDAT related comments document. F025, K002-K008, K011, K013-15, K046, K061, K069. volume 1-k, 15:49526 (R;US)

ACTINIDE COMPOUNDS
See also PLUTONIUM COMPOUNDS
URANIUM COMPOUNDS
Actinide chemistry, 15:49004 (RA;US)

ACTINIDES
See also PLUTONIUM
URANIUM
Kinetically inert lanthanide amine complexes, 15:49005 (RA;US)
The TRansUranium EXtraction (TRUEX) process: A vital tool for disposal of US defense nuclear waste, 15:48257 (R;US)
The transuranium elements: Members of the 5f series, 15:49869 (R;US)
$[Li(Me_2NCH_2CH_2NMe_2)_2]$-$[Li_2(Me_2NCH_2CH_2NMe_2)_2$ (μ-η^5, η^5-$MeC_5H_4)]$-$[(\eta^5$-$MeC_5H_4)_6U$..., 15:49006 (RA;US)

ADENOCARCINOMAS
See CARCINOMAS

ADSORBENTS
See also CHARCOAL
MOLECULAR SIEVES
SILICA GEL
A new method for surface structure using a combination of second harmonic generation and coverage-dependence fluorescence, 15:49035 (RA;US)

ADVANCED GAS COOLED GRAPHITE MODERATED REACTOR
See AGR TYPE REACTORS

AEROSOLS
See also RADIOACTIVE AEROSOLS
Current status of forest decline and its research activities in Europe, 15:48702 (R;JP;In Japanese)
Problems in aircraft measurement of trace atmospheric species, 15:49559 (BA;US)

AFRICA
See also SOUTH AFRICA
TUNISIA
African energy programme, a perspective of a regional project network, 15:48756 (R;GB)

AGR TYPE REACTORS
Inherently safe characteristics of nuclear reactors, 15:48532 (R;FR)

AGRICULTURAL RESIDUES
See AGRICULTURAL WASTES
AGRICULTURAL WASTES
Biomass fuels proven dependable at work on Ontario farms, 15:48816 (R;CA)
AGRICULTURE
The optical parametrization of an aerial multispectral camera, 15:49599 (R;FI)
AIR
See also SURFACE AIR
Energy conservation and hospital hygiene, 15:48785 (R;FI;In Finnish)
New method permits the detection of alpha emitters at a distance, 15:49563 (J;US)
Radioactivity measurements in Europe after the Chernobyl accident: Part I: Air, 15:48648 (R;FR)
AIR CONDITIONERS
Development of the fuzzy control system for heat-pump air conditioners, 15:48791 (R;JP)
AIR POLLUTION
See also INDOOR AIR POLLUTION
Air/Superfund national technical guidance study series. Development of example procedures for evaluating the air impacts of soil excavation associated with Superfund remedial actions. Final report, 15:49544 (R;US)
Computation of emissions from exhaust-gas composition measurements, 15:48148 (R;US)
Frequency profiles of residential wood burning for the northwestern United States, 15:48442 (R;US)
Members committee report: Critical point one, 15:49465 (R;CA)
Report of the Expert Group on Emissions Scenarios of the Response Strategies Working Group of the Intergovernmental Panel on Climate Change. Appendix. Technical report (Draft), 15:49542 (R;US)
Technical committee for the long-range transport of atmospheric pollutants in western and northern Canada: Annual report, 1987, 15:49467 (R;CA)
The role of clouds and precipitation in the long-range transport of air pollutants and acid rain formation in Canada: Phase 2. Programming, testing and refining of cloud dynamics, microphysics and chemistry models, 15:49473 (R;CA)
AIR POLLUTION ABATEMENT
Costs of alternate strategies for reducing nitrogen oxide and volatile organic compounds. Emissions from stationary sources in Ontario, 15:49470 (RA;CA)
Let's clear the air, 15:48842 (R;CA)
Study of the options for reduction of energy-related greenhouse gas emissions, 15:49471 (RA;CA)
AIR POLLUTION CONTROL
Study of the options for reduction of energy-related greenhouse gas emissions, 15:49471 (RA;CA)
AIR POLLUTION MONITORING
Measurement of biogenic and anthropogenic volatile organic compounds during the Canadian Atmospheric Study, July 17 to August 31, 1988, 15:49472 (R;CA)
New method permits the detection of alpha emitters at a distance, 15:49563 (J;US)
AIR POLLUTION MONITORS
An overview of instrumentation for measuring environmental radon and radon progeny, 15:49562 (J;US)
AIR QUALITY
Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 1: Final report, 15:48774 (R;CA)
Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 2: Final report, 15:48775 (R;CA)
Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 3: Final report, 15:48776 (R;CA)
Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 4: Final report, 15:48777 (R;CA)
Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 5: Final report, 15:48778 (R;CA)
Reactor processes in synthetic organic chemical manufacturing industry. background information for proposed standards. Draft report, 15:49540 (R;US)
AIR SAMPLERS
Measurements of exhaled breath using a new portable sampling method, 15:49538 (R;US)
AIR TRANSPORT
Quality Assurance (QA) plan for the Airlift Deployment Analysis System (ADANS), 15:49391 (R;US)
Use of excess carbon-14 data to test 2D stratospheric models, 15:49462 (RA;US)
AIRBORNE PARTICLES
See PARTICULATES
AIRBORNE PARTICULATES
See PARTICULATES
AIRCRAFT
Classification of acoustic emission waveforms for nondestructive evaluation using neural networks, 15:50239 (R;US)
AIRCRAFT ACCIDENTS
See ACCIDENTS
AIRFOILS
Atmospheric performance of the special-purpose Solar Energy Research Institute (SERI) thin-airfoil family: Final results, 15:48484 (R;US)
ALABAMA
Ecological characterization atlas of coastal Alabama: Map narrative, 15:49571 (R;US)
ALARM SYSTEMS
See also INTRUSION DETECTION SYSTEMS
A Nuisance Alarm Data System for evaluation of intrusion detectors, 15:49379 (R;US)
ALBERTA
Alberta electric industry annual statistics 1987, 15:48754 (R;CA)
Alberta oil sands annual statistics, 1987, 15:48204 (R;CA)
Alberta reclamation research annual report, 1987, 15:48734 (R;CA)
Alberta's reserves of crude oil, oil sands, gas, natural gas liquids, and sulphur, 15:48131 (R;CA)
Amoco Canada Resources Ltd., Chevron Canada Resources, Kaybob South Beaverhill Lake A pool: Decision 89-9, 15:48184 (R;CA)
Application by Canadian Western Natural Gas Company Limited for a permit to construct a pipeline to transport natural gas in the Magrath area: Decision 89-11, 15:48182 (R;CA)
Chesapeake Resources Ltd. application for a well licence, Whitemud area: Decision 90-3, 15:48168 (R;CA)
Gannon Bros Energy Ltd. application for a well licence, Ewing Lake field: Decision 89-10, 15:48167 (R;CA)
Government of Alberta ethane policy implementation procedures: Information letter 90-9, 15:48186 (R;CA)
Plains hydrology and reclamation project: Spoil ground-water chemistry and its impacts on surface water, 15:48098 (R;CA)
Towards a strategy for adapting to climate change in Alberta, 15:49455 (R;CA)
ALCOHOL FUEL CELLS
Development of a high performance air cathode for the direct methanol/air fuel cell: Final report, 15:48761 (R;LU)
ALKALINE ELECTROLYTE FUEL CELLS
Manufacture of air electrodes and long run tests, 15:48763 (R;FI)
ALLOY 800
See INCOLOY 800
ALLOY SU31
See NIOBIUM BASE ALLOYS
ALLOY-50KH4N6G12F2V
See CHROMIUM ALLOYS
ALLOY-60T
See TITANIUM BASE ALLOYS
ALLOY-79NM
See NICKEL BASE ALLOYS
ALLOY-B-66
See NIOBIUM BASE ALLOYS
ALLOY-B-88
See NIOBIUM BASE ALLOYS
ALLOY-C-129Y
See NIOBIUM BASE ALLOYS
ALLOY-CB-1
See NIOBIUM BASE ALLOYS

ALLOY-CB-752
See NIOBIUM BASE ALLOYS
ALLOY-D-43
See NIOBIUM BASE ALLOYS
ALLOY-DH-245
See NIOBIUM BASE ALLOYS
ALLOY-FE44NI33CR21
Effects of environment and aging on creep properties of Alloy 800H, 15:48882 (R;JP;In Japanese)
ALLOY-FS-85
See NIOBIUM BASE ALLOYS
ALLOY-GE
See COPPER ALLOYS
ALLOY-GMR-235
See NICKEL BASE ALLOYS
ALLOY-HD-8077
See NICKEL BASE ALLOYS
ALLOY-KH20N80T
See NICKEL BASE ALLOYS
ALLOY-KHN77TYU
See NICKEL BASE ALLOYS
ALLOY-M-252
See NICKEL BASE ALLOYS
ALLOY-MA-754
See NICKEL BASE ALLOYS
ALLOY-MA-956
See IRON BASE ALLOYS
ALLOY-MM-0011
See NICKEL BASE ALLOYS
ALLOY-VTZ-1
See TITANIUM BASE ALLOYS
ALLOY-VUS-6
See NIOBIUM BASE ALLOYS
ALLOY-WAZ-16
See NICKEL BASE ALLOYS
ALLOY-ZR98SN-4
Study of radiation effects on zircaloy 4 microstructure (Impact on susceptibility to fuel pellet-cladding interaction in PWR), 15:48873 (R;FR;In French)
ALLOYS
See also ALUMINIUM ALLOYS
CADMIUM ALLOYS
CHROMIUM ALLOYS
COBALT ALLOYS
COPPER ALLOYS
GERMANIUM ALLOYS
INTERMETALLIC COMPOUNDS
IRON ALLOYS
LITHIUM ALLOYS
MAGNESIUM ALLOYS
MOLYBDENUM ALLOYS
NICKEL ALLOYS
NIOBIUM ALLOYS
RARE EARTH ALLOYS
SILICON ALLOYS
TANTALUM ALLOYS
TITANIUM ALLOYS
TRANSITION ELEMENT ALLOYS
ZIRCONIUM ALLOYS
Liquid alloys with strong interactions, 15:48868 (R;US)
ALLUVIAL DEPOSITS
Alluvial valley floor identification and study guidelines. Final report, 15:48103 (R;US)
ALPHA PARTICLES
Production of high energy nuclei ^{4}He,^{3}He,^{3}H,^{2}H in interaction 10.1 GeV/c protons with Be,Al,Cu,Ta, 15:50032 (R;SU)
ALPHA-BEARING WASTES
Hanford Site radioactive solid waste acceptance criteria, 15:48292 (R;US)
Preliminary model of repository chemistry for the Waste Isolation Pilot Plant, 15:48288 (R;US)
Waste Isolation Pilot Plant site specific plan: Revision 2, 15:48260 (R;US)
ALUMINATES
Evaluation of room-temperature chloroaluminate molten salts as electrolytes for high energy density batteries. Final report, June 1988-April 1990, 15:48691 (R;US)
ALUMINIA
See ALUMINIUM OXIDES
ALUMINIUM
Aluminum metal combustion in water revealed by high speed microphotography, 15:49395 (R;US)
Calculation of energy release depth distributions for electrons with 5-100 MeV energy in thick targets, 15:50057 (RA;SU;In Russian)
Characterization of short fatigue cracks at notches in SiC particulate aluminum composite, 15:48957 (R;US)
Wear-metal analysis in engine oil by microwave digestion and atomic absorption spectroscopy. Final report, August 1987-January 1988, 15:48988 (R;US)
ALUMINIUM 27 TARGET
Complex fragment emission in binary and multifragment decay of very hot nuclear systems, 15:50001 (R;US)
ALUMINIUM ALLOYS
Corrosion fatigue crack propagation in metals, 15:48893 (R;US)
Corrosion protection of metal-matrix composites. Final report, October 1986-April 1990, 15:48855 (R;US)
In-situ studies of ion irradiation effects in an electron microscope, 15:48985 (J;US)
Investigation of thermo-mechanical effects in silicon carbide whisker/Al alloy composites. Final report, 1 March 1985-31 August 1989, 15:48902 (R;US)
Mechanical properties, fracture behavior, and grain-boundary chemistry of B-doped NiAl, 15:48867 (R;US)
Metal-matrix composites - a promising alternative to conventional alloys, 15:48908 (R;DE)
Short-fibre and particulate-reinforced metal-matrix composites, 15:48907 (R;US)
Study of constitution diagram aluminum-tantalum, 15:48856 (R;US)
The stability of irradiation-induced defects in NiAl, 15:48864 (R;US)
ALUMINIUM ARSENIDES
Electric-field dependent electroreflectance and photocurrent spectroscopy in InGaAs/InAlAs strained-layer superlattices, 15:48974 (R;US)
Ion mixing of semiconductor superlattices, 15:48951 (R;US)
Photoluminescence studies of $In_xGa_{1-x}As/Al_yGa_{1-y}As$ strained-layer structures: Effects of annealing, 15:48976 (R;US)
Quasiparticle calculation of valence-band offset of AlAs-GaAs(001), 15:50085 (RA;US)
ALUMINIUM BROMIDES
Structure of molten salts, 15:48949 (R;US)
ALUMINIUM OXIDES
Effect of interfacial characteristics on the mechanical performance of ceramic-ceramic composites. Final report, July 1986-December 1989, 15:48906 (R;US)
Improved Fischer-Tropsch Synthesis catalysts for indirect coal liquefaction: Quarterly technical progress report No. 8, 1 July–30 September 1987, 15:48075 (R;US)
Indentation testing of thin films and hard materials, 15:48912 (R;US)
Metal-matrix composites - a promising alternative to conventional alloys, 15:48908 (R;DE)
Short-fibre and particulate-reinforced metal-matrix composites, 15:48907 (R;US)
TEM characterization of nanocrystals produced by decomposition reactions, 15:48929 (RA;US)
Thermal stresses in layered electrical assemblies bonded with solder, 15:49218 (R;US)
ALUMINIUM SILICATES
See also KAOLINITE
Luminescence study of spodumene, 15:50071 (R;BR)
ALUMINUM
See ALUMINIUM
ALVEOLI (PULMONARY)
See LUNGS

AMERICIUM 241
US Mussel Watch Program: Transuranic element data from Woods Hole Oceanographic Institution 1976-1983. Technical report, 15:49610 (R;US)
AMINOBENZENE
See ANILINE
AMMONIA
Final response to BDAT related comments document: General BDAT issues. Volume 1-A-3, 15:49517 (R;US)
AMMONIUM COMPLEXES
An ionic system with critical point at 44°C, 15:49042 (RA;US)
Work in progress, 15:49142 (RA;US)
ANALOG-TO-DIGITAL CONVERTERS
Information plates TP, δT and T2A for the KLYuKVA data collection system, 15:49207 (R;SU;In Russian)
ANALYSIS (GAS)
See GAS ANALYSIS
ANGARA-5 DEVICE
Technique for calculation of electrostatic fields of high-current accelerator elements, 15:50174 (R;SU;In Russian)
ANGIOGRAPHY
See BIOMEDICAL RADIOGRAPHY
ANGRA-1 REACTOR
Simplified model of a PWR primary circuit, 15:48561 (R;BR;In Portuguese)
ANHARMONIC OSCILLATORS
Two new types of solvability of the one-dimensional anharmonic oscillators, 15:49971 (R;SU)
ANILINE
Best demonstrated available technology (BDAT) background document for distillation bottoms from the production of aniline K083. Final report, 15:49507 (R;US)
ANIMAL BREEDING
Partial room brooding for poultry, 15:48788 (R;CA)
ANIMAL SHELTERS
Growth room temperature control with water-source heat pumps, 15:48787 (R;CA)
Heat exchangers reduce costs, provide better livestock environment, 15:48815 (R;CA)
ANIMALS
Ecological characterization atlas of coastal Alabama: Map narrative, 15:49571 (R;US)
Texas Barrier Islands Region ecological characterization atlas: Biological resources narrative, 15:49570 (R;US)
ANL
Isotope geochemistry: A critical component of energy research, 15:49739 (R;US)
Nuclear Technology Programs semiannual progress report, October 1987–March 1988, 15:48729 (R;US)
ANNEALING
Refining of crystal structures of macromolecules with molecular dynamics, 15:49863 (RA;BR;In Portuguese)
ANODES
Corrosion and arc erosion in MHD channels: Quarterly progress report, January–March 1990, 15:48757 (R;US)
The corrosion of carbon black anodes in alkaline electrolyte: IV. Current efficiencies for oxygen evolution from metal oxide-impregnated graphitized furnace blacks, 15:49104 (RA;US)
ANSTO
Environmental survey at Lucas Heights Research Laboratories, 1987, 15:48372 (R;AU)
ANTARCTIC OCEAN
See SEAS
ANTENNAS
Compact representation of radiation patterns using spherical mode expansions: Final report, 15:49219 (R;US)
ANTHRACENE
Enhanced photooxidation of anthracene on SiO_2, 15:49144 (BA;US)
ANTIFERROMAGNETIC MATERIALS
Magnetic properties of Hubbard-sigma model with three-dimensionality, 15:48917 (R;JP)
ANTILAMBDA PARTICLES
Analysis of the reaction p-barp→Λ-barΛ near the threshold, 15:49940 (R;SU)
ANTIMONY OXIDES
Superconducting and structural properties of the $(Ba_{0.6}K_{0.4})(Bi_{1-y}Sb_y)O_3$ system, 15:48910 (R;US)
ANTINEUTRINO-NEUTRON INTERACTIONS
Determination of value of the $\sigma(\nu\text{-barn}\rightarrow\mu^{\pm}X)\sigma(\nu\text{-barp}\rightarrow\mu^{\pm}X)$ cross section ratio at neutrino energies up to 30 GeV, 15:49928 (R;SU;In Russian)
ANTINEUTRINO-PROTON INTERACTIONS
Determination of value of the $\sigma(\nu\text{-barn}\rightarrow\mu^{\pm}X)\sigma(\nu\text{-barp}\rightarrow\mu^{\pm}X)$ cross section ratio at neutrino energies up to 30 GeV, 15:49928 (R;SU;In Russian)
ANTIPROTONS
Circulation ring and mass screening of unstable nucleus, 15:49280 (RA;JP;In Japanese)
APERTURES
Design of thick apertures for high-resolution neutron penumbral imaging, 15:49327 (J;US)
APPARATUS
See EQUIPMENT
AQUATIC ECOSYSTEMS
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): Striped bass, 15:49588 (R;US)
AQUATIC ORGANISMS
See also FISHES
Texas Barrier Islands Region ecological characterization atlas: Biological resources narrative, 15:49570 (R;US)
AQUEOUS SOLUTIONS
The chemistry of plutonium(VI) in aqueous carbonate solutions, 15:49033 (R;US)
AQUIFERS
Chemical use and distribution in the Regina aquifer region. Volume I: Executive Summary – Volume II: Report and appendices, 15:49602 (R;CA)
Results from a workshop on research needs for modeling aquifer thermal energy storage systems, 15:48690 (R;US)
ARAMIDS
Thin-film composite materials, Phase 2. Final report, 1 April-31 December 1986, 15:48948 (R;US)
ARC FURNACES
Recycling of electric-arc-furnace dust, 15:48824 (R;US)
ARCHITECTURE
Integration of simulation into building design: The need for a joint approach, 15:48783 (R;US)
ARCTIC REGIONS
Revegetation in the Canadian north. A 15 year perspective: Summary of findings, 15:48163 (RA;CA)
ARGON
Angle-resolved photoemission from the Ar 2p subshell, 15:49132 (RA;US)
Tunable far-infrared laser spectroscopy of van der Waals bonds: Vibration-rotation-tunneling spectra of Ar-H_2O, 15:49139 (RA;US)
ARGON 31
Search for β -^{2} He, β - p α and β - ^{3}p in the proton-rich nucleus ^{31}Ar, 15:50003 (R;FR)
ARGON 40 BEAMS
Isotopical separation of relativistic projectile fragments, first experiments at SATURNE, 15:50006 (RA;FR)
ARGON 40 REACTIONS
Central collisions at the fermi energy, 15:50012 (R;FR)
Charged pion production in nucleus-nucleus collisions at E/A between 400 and 800 mev, 15:50007 (R;FR;In French)
Study of the linear momentum transfer distribution in the ^{40} Ar + ^{12}C system at 27, 32, 36, 40, 44 and 60 MeV/A, 15:49998 (R;FR;In French)
ARGON CHLORIDES
Far-infrared laser Stark spectroscopy of the Σ bending vibration of ArHCl, 15:48999 (RA;US)

Tunable far-infrared laser spectroscopy of van der Waals bonds: Extended measurements on the lowest Σ bend of ArHCl, 15:49000 (RA;US)
Tunable far-infrared laser spectroscopy of van der Waals bonds: Extended measurements on the lowest Σ bend of ArHCl, 15:49136 (RA;US)

ARGON COMPOUNDS
See also ARGON CHLORIDES
ARGON HYDRIDES
ARGON IODIDES
Resonance ionization spectroscopy of molecular clusters using picosecond lasers, 15:48992 (R;US)
Tunable far-infrared laser spectroscopy of van der Waals bonds: Vibrational-rotation-tunneling spectra of Ar-H_2O, 15:49047 (RA;US)

ARGON HYDRIDES
Far-infrared laser Stark spectroscopy of the Σ bending vibration of ArHCl, 15:48999 (RA;US)
Tunable far-infrared laser spectroscopy of van der Waals bonds: Extended measurements on the lowest Σ bend of ArHCl, 15:49136 (RA;US)
Tunable far-infrared laser spectroscopy of van der Waals bonds: Extended measurements on the lowest Σ bend of ArHCl, 15:49000 (RA;US)

ARGON IODIDES
Resonance ionization spectroscopy of molecular clusters using picosecond lasers, 15:48992 (R;US)

ARGON IONS
Double and single electron capture in slow collisions of $Ar^{9,8+}$ ions with He atoms, 15:49889 (RA;US)

ARGONNE NATIONAL LABORATORY
See ANL

ARMOR
Dynamic properties of porous B_4C. Interim report, 15:49389 (R;US)

ARMS CONTROL
Intelligence support to arms control. Study project, 15:48850 (R;US)
Risk of disclosure of sensitive information during warhead dismantlement, 15:48851 (R;US)

ARRAY PROCESSORS
SISAL versus FORTRAN: A comparison using the Livermore Loops: Revision 2, 15:50242 (R;US)
The scalable coherent interface, IEEE P1596: Status and possible applications to data acquisition and physics, 15:49334 (J;US)

ARSENIC
Final best demonstrated available technology (BDAT) background document for K031, K084, K101, K102, characteristic arsenic wastes (D004), characteristic selenium wastes (D010), and P and U wastes containing arsenic and selenium listing constituents. Volume 1, 15:49475 (R;US)
Final response to BDAT related comments document. D004: Characteristic wastes for arsenic and K, P, and U wastes containing arsenic and D010: Characteristic wastes for selenium. Volume 1-E, 15:49520 (R;US)
Formation and stability of As-H bonds in H-implanted GaAs, 15:49083 (R;US)

ASBESTOS
Integrated criteria document: Asbestos effects, 15:49537 (R;NL)
Integrated criteria document: Asbestos effects. Appendix, 15:49722 (R;NL)
Task Order 2 enhanced preliminary assessment, Fort Douglas, Salt Lake City, Utah. Final report, October-December 1989, 15:49416 (R;US)
Task order enhanced preliminary assessment, New Orleans Military Ocean Terminal, New Orleans, Louisiana. Final report, October-December 1989, 15:49417 (R;US)

ASHES
See also FLY ASH
Reuse of incinerated soil residues in land reclamation, 15:49567 (R;US)

ASPHALTENES
A study of asphaltene flocculation in heavy oil and asphalt solutions: Final report, 15:48174 (R;CA)
Study of asphaltene flocculation in heavy oil and asphalt solutions, 15:48173 (R;CA)

ASPHALTS
See also ASPHALTENES
Catalytic hydrotreatment of refinery waste: Demonstration project: Final report, 15:48145 (R;LU)
Study of asphaltene flocculation in heavy oil and asphalt solutions, 15:48173 (R;CA)

ASSE SALT MINE
Hydrogeological investigations at the Asse salt mine, 15:48282 (RA;DE;In German)

ASTATINE 211
Introduction of astatine into monoclonal antibodies, 15:49150 (R;SU;In Russian)

ASTATINE COMPOUNDS
Introduction of astatine into monoclonal antibodies, 15:49150 (R;SU;In Russian)

ASTRONAUTS
Improved model for solar cosmic ray exposure in manned Earth orbital flights, 15:49716 (R;US)

ASTRONOMY
The 1973 x-ray outburst of 4U1145-61, 15:49842 (BA;US)
The South African Astronomical Observatory, 15:49826 (R;ZA)

ASTROPHYSICS
Stellar astrophysics, 15:49827 (RA;ZA)
The South African Astronomical Observatory, 15:49826 (R;ZA)

ATF TORSATRON
Edge turbulence and transport: Text and ATF modeling, 15:50112 (R;US)
Fluctuations and stability in the Advanced Toroidal Facility (ATF) torsatron, 15:50132 (R;US)

ATHABASCA DEPOSIT
Experiences with in situ monitoring instrumentation at AOSTRA's [Alberta Oil Sands Technology and Research Authority] underground test facility, 15:48197 (RA;CA)

ATMOSPHERIC CHEMISTRY
Problems in aircraft measurement of trace atmospheric species, 15:49559 (BA;US)

ATMOSPHERIC CIRCULATION
Use of excess carbon-14 data to test 2D stratospheric models, 15:49462 (RA;US)

ATMOSPHERIC EXPOSURE CHAMBERS
See EXPOSURE CHAMBERS

ATMOSPHERIC PRECIPITATIONS
Red Canyon wash infiltration studies, 15:49592 (R;US)

ATOM COLLISIONS
See also ATOM-ATOM COLLISIONS
ATOM-MOLECULE COLLISIONS
ELECTRON-ATOM COLLISIONS
ION-ATOM COLLISIONS
High-energy atomic physics, 15:49887 (RA;US)
Monte Carlo path integration for the real-time propagator, 15:50227 (RA;US)
The physics of electronic and atomic collisions, 15:49868 (B;US)
Theory of atomic and molecular collision processes, 15:50226 (RA;US)

ATOM-ATOM COLLISIONS
A diabatic reaction-path Hamiltonian, 15:50229 (RA;US)

ATOM-MOLECULE COLLISIONS
Crossed-molecular-beam studies of the reactions of methyl radicals with iodoalkanes, 15:49884 (RA;US)
Dynamics of endoergic substitution reactions. II. Br + (CH_2CCl_2) → Cl + (CH_2CClBr), 15:49883 (RA;US)
Dynamics of endoergic substitution reactions: I. Br + chlorinated aromatic compounds, 15:49882 (RA;US)
Polarization effects in reactive scattering of Na atoms in the 4D level, 15:49885 (RA;US)

ATOMIC BOMBS
See NUCLEAR WEAPONS

ATOMIC EXPLOSIONS
See NUCLEAR EXPLOSIONS

ATOMIC FLUORESCENCE SPECTROSCOPY
See FLUORESCENCE SPECTROSCOPY
ATOMIC PHYSICS
Atomic physics, 15:49888 (RA;US)
ATOMIC WEAPONS
See NUCLEAR WEAPONS
ATOMS
See also MUONIC ATOMS
Molecular interactions, 15:49145 (RA;US)
AURORAE
Simultaneous relativistic-electron and auroral-particle access to the polar caps during interplanetary magnetic field Bz northward: A scenario for an open-field line source of auroral particles, 15:49852 (R;US)
AURORAL SUBSTORMS
See MAGNETIC BAYS
AURORAL ZONES
Viking data analysis. Final technical report, August 1986-March 1990, 15:49853 (R;US)
AUSTENITIC STEELS
See also STEEL-CR17NI12MO3-L
Joint research centre fusion materials irradiations in HFR: Present status and prospectives, 15:50173 (RA;FR)
AUSTRALIA
Review and evaluation of main roadway intersection techniques for use in the Sydney coal field, 15:48102 (R;CA)
AUTOMOBILE EFFICIENCY STANDARDS
See AUTOMOBILES
AUTOMOBILES
I/m test variability. Technical report, 15:48160 (R;US)
AUTOMOTIVE FUELS
The results and politics of oxygenated fuels in Colorado, 15:48844 (RA;CA)
AXIONS
Axions and SN 1987A: Axion trapping, 15:49824 (R;US)
Periodic signatures for the detection of cosmic axions, 15:49819 (R;US)
AXONS
See NERVE CELLS

B

B MESONS
See also B NEUTRAL MESONS
μ particle detector, 15:49313 (RA;JP;In Japanese)
B meson physics on Y (4s), 15:49952 (RA;JP)
Comparison of B factories, 15:49953 (RA;JP;In Japanese)
Electromagnetic shower calorimeter, 15:49310 (RA;JP;In Japanese)
Measurement of Bs-Bs-bar mixing, 15:49914 (RA;JP;In Japanese)
Tracking, 15:49312 (RA;JP;In Japanese)
B NEUTRAL MESONS
A study on CP violation, 15:49961 (RA;JP;In Japanese)
CP violating decay of neutral B meson, 15:49960 (RA;JP;In Japanese)
Measurement of V_{ub}, 15:49913 (RA;JP;In Japanese)
Supersymmetric version of horizontal gauge interactions, 15:49931 (R;SU)
BACTERIA
See also SULFUR-OXIDIZING BACTERIA
Development of water purification technologies for intensive fish culture. 3.: Selection of marine denitrifying bacteria by their denitrification pattern, 15:49591 (R;JP;In Japanese)
Isolation and properties of plasmids from Deinococcus radiodurans Sark, 15:49714 (R;JP)
BACTERIOPHAGES
Control of microbiofouling using bacteriophage. 2.: Detection of phages and fundamental study of their lytie effect on fouling bacteria, 15:48487 (R;JP;In Japanese)
BAGHOUSES
Dry FGD [flue-gas desulfurization] at Argonne National Laboratory, 15:48500 (R;US)
BALLISTIC MISSILE DEFENSE
Reference concepts for a space-based hydrogen-oxygen combustion, turboalternator, burst power system, 15:49406 (R;US)
BANKS
See COMMERCIAL BUILDINGS
BARC
Radiochemistry Division: annual progress report: 1987, 15:49147 (R;IN)
BARIUM
Final best demonstrated available technology (BDAT) background document for barium wastes (D005 and P013). Volume 20, 15:49494 (R;US)
Final response to BDAT related comments document: D005: Characteristic wastes for barium, and P013 and D006: Characteristic wastes for cadmium. Volume 1-F, 15:49521 (R;US)
Retention of alkaline earth elements in man: Final report for the period 1 April 1986 - 14 May 1989, 15:49712 (R;XA)
BARIUM COMPOUNDS
See also BARIUM OXIDES
Dielectric properties of fluxed barium titanate ceramics with zirconia additions, 15:48945 (J;US)
BARIUM OXIDES
Development of high-Tc superconducting wire with high critical current density, 15:48935 (R;JP)
Fabrication of composite high temperature superconductor wires from $Ag/YBa_2Cu_3O_x$ power produced by $AgNO_3$ decomposition, 15:48901 (R;US)
In-situ transmission electron microscopy and computer simulation study of the kinetics of oxygen loss in $YBa_2Cu_3O_z$, 15:48932 (R;US)
International workshop on ion beam modification and processing of high-Tc superconductors: Physics and devices: Program and abstracts, 15:48905 (R;GB)
Processing of $YBA_2Cu_3O_7$ tapes from a molten salt precursor, 15:48924 (R;US)
Superconducting and structural properties of the $(Ba_{0.6}K_{0.4})(Bi_{1-y}Sb_y)O_3$ system, 15:48910 (R;US)
The upper critical field of $HoBa_2Cu_3O_{7-\delta}$ for H || c, 15:48918 (R;US)
Thermodynamic critical field of $Y_1Ba_2Cu_3O_7$, 15:48921 (R;US)
$YBa_2Cu_3O_x$ composites with improved toughness and strength, 15:48916 (R;US)
BARYON RESONANCES
See BARYONS
BARYONS
See also HYPERONS
N*BARYONS
NUCLEONS
Baryogenesis in extended inflation. Part 1: Baryogenesis via production and decay of supermassive bosons, 15:49818 (R;GB)
Cosmological baryon and lepton number in the presence of electroweak fermion-number violation, 15:49820 (R;US)
BATTELLE PACIFIC NORTHWEST LABORATORIES
Isotope geochemistry: A critical component of energy research, 15:49739 (R;US)
BATTERIES (ELECTRIC)
See ELECTRIC BATTERIES
BATTERY CHARGING
A microprocessor based charge control system for the simultaneous charging of several batteries with one charge controller: Final report for 1989, 15:48839 (R;US)
BEAM BENDING MAGNETS
Optimization of the shape of the bending magnets cross section for electron accelerators and storage rings, 15:49246 (R;SU)
BEAM BUNCHING
A very wide bandwidth Faraday cup suitable for measuring gigahertz structure on ion beams with velocities down to $\beta < 0.01$, 15:49241 (R;US)
BEAM EMITTANCE
Increase of strip beam emittance in linear focusing systems, 15:49234 (R;SU;In Russian)
BEAM PERVEANCE
See BEAM EMITTANCE

BEAM STRIPPERS
Study on charge exchange and radiation resistance of carbon targets in the I-2 proton linear accelerator, 15:49257 (R;SU;In Russian)
BEAM TRANSPORT
On the beam impedance of shallow tapered cavities, 15:49236 (R;US)
BEAM-PLASMA SYSTEMS
Excitation of regular oscillations and acceleration of charged particles by electron beam in a non-uniform plasma resonator, 15:50159 (R;UA;In Russian)
Forced scattering of a non-ordinary electromagnetic wave by an electron beam in a plasma in magnetic field, 15:50157 (R;UA;In Russian)
Stochastic electron beams in the ion-focused regime, 15:49893 (R;US)
BEAN PLANT
See PHASEOLUS
BEAUFORT SEA
Response to recommendation No. 80, Beaufort Sea environmental assessment and review panel: Final report, 1984-89, 15:48171 (R;CA)
BEAUTY PARTICLES
Measurement of the $e^+e^- \rightarrow b\bar{b}$ cross section and forward-backward charge asymmetry at a center-of-mass energy of 57.2 GeV, 15:49905 (R;US)
BELGIAN REACTOR 2
See BR-2 REACTOR
BENZENE
Observation of correlation effects in zero kinetic energy electron spectra near the N1s and C1s thresholds in N_2, CO, C_6H_6, and C_2H_4, 15:49131 (RA;US)
Resonant processes above the carbon 1s ionization threshold in benzene and ethylene, 15:49133 (RA;US)
BERKELEY BEVALAC
See BEVALAC
BERYLLIUM
Beryllium disease: A summary of the occupational health concern, 15:49718 (R;CA)
Microscopic integral cross section measurements in the Be(d,n) neutron spectrum for applications in neutron dosimetry, radiation damage and the production of long-lived radionuclides, 15:49980 (R;US)
BERYLLIUM 13
Neutron-rich isotopes of the lightest elements, 15:49991 (R;SU)
BERYLLIUM 6
Optimization of kinematically complete experiments in four-particle nuclear reactions by simulation method, 15:50027 (R;SU;In Russian)
BERYLLIUM 7
Comparison of theoretical and phenomenological phase shifts for $^3He(\alpha,\alpha)^3He$ scattering at ^7Be excitation range between 25 and 42 MeV, 15:50034 (R;UA)
BERYLLIUM MODERATORS
See BERYLLIUM
BETA BEAMS (ELECTRONS)
See ELECTRON BEAMS
BETA BEAMS (POSITRONS)
See POSITRON BEAMS
BETA DECAY
Search for β -^{2} He, β - p α and β - ^{3}p in the proton-rich nucleus ^{31}Ar, 15:50003 (R;FR)
Superallowed Fermi beta-decay: Applications, 15:50051 (R;CA)
BETA SOURCES
Survey instrument response to beta radiations, 15:49354 (J;US)
BETA SPECTROMETERS
Survey instrument response to beta radiations, 15:49354 (J;US)
BEVALAC
A multi-channel waveform digitizer system, 15:49338 (J;US)
BGO DETECTORS
The shuttle activation monitor: A system for direct comparison of gamma-ray detector materials in a space environment, 15:49362 (J;US)
BHABHA ATOMIC RESEARCH CENTER
See BARC
BINARY MIXTURES
An ionic system with critical point at 44°C, 15:49042 (RA;US)
High-temperature mutual solubilities for some binary and ternary aqueous mixtures containing aromatic and chlorinated hydrocarbons, 15:49069 (RA;US)
Near-critical NaCl-H_2O: An equation of state and discussion of anomalous properties, 15:49041 (RA;US)
Thermodynamics of electrolyte mixtures. Activity and osmotic coefficients consistent with the higher-order limiting law for symmetrical mixing, 15:49044 (RA;US)
Thermodynamics of liquid-liquid equilibria including the critical region, 15:49157 (RA;US)
Work in progress, 15:49072 (RA;US)
BINARY STARS
Observations of Cygnus X-2 with IUE: Ultraviolet results from a multiwavelength campaign, 15:49837 (B;DE)
Self-sustained mechanism of mass transfer and evolution of very low mass x-ray binaries, 15:49841 (BA;US)
BINARY-FLUID SYSTEMS
Studies of chemical reactivity in condensed phase, 15:49037 (RA;US)
BIOCENOSES
See ECOSYSTEMS
BIOFOULING
See BIOLOGICAL FOULING
BIOGAS
See METHANE
BIOGEOCENOSES
See ECOSYSTEMS
BIOLOGICAL FOULING
Control of microbiofouling using bacteriophage. 2.: Detection of phages and fundamental study of their lytic effect on fouling bacteria, 15:48487 (R;JP;In Japanese)
BIOLOGICAL MATERIALS
Texas Barrier Islands Region ecological characterization atlas: Biological resources narrative, 15:49570 (R;US)
BIOLOGICAL REACTORS
See BIOREACTORS
BIOMASS
A pyrolysis mill for fast pyrolysis of biomass, 15:48423 (RA;LU)
Advanced biomass pyrolysis technology in the US, 15:48419 (RA;LU)
Advanced vacuum pyrolysis project: State of the art and perspectives, 15:48421 (RA;LU)
Alten activities in the field of biomass exploitation for energetic uses, 15:48429 (RA;LU)
Bio-energy-industrial integrated regional projects in the European community, 15:48409 (RA;LU)
Biomass pyrolysis technology and products. A Canadian viewpoint, 15:48420 (RA;LU)
Catalytic treatment of pyrolysis oils, 15:48435 (R;LU)
Flexibility of mass produced engines as shaft power and electricity conversion carriers for biomass derived fuels, 15:48430 (RA;LU)
Project LEBEN - Galicia (Spain): Energy exploitation of biomass, 15:48416 (RA;LU)
Pyrolysis liquids: Problems and opportunities for utilization, 15:48426 (RA;LU)
Pyrolysis of biomass - A vertical flow packed-bed system: Production of char, oil and gases, 15:48428 (RA;LU)
Pyrolysis of biomass for the production of char, oil and gases, 15:48427 (RA;LU)
Pyrolysis technology and products - Introduction, 15:48417 (RA;LU)
Technical possibilities and economic conditions of producing biomass for energy, 15:48410 (RA;LU)
Technique of carbonization and pyrolysis, 15:48432 (RA;LU)
The LEBEN project as an example of an integrated agro-energy approach, 15:48415 (RA;LU)
The pyrolysis for biomass is available in industry-scale and ready for the production of energy, 15:48418 (RA;LU)

Thermochemical conversion of biomass: A study on the pyrolysis of biomass, 15:48434 (RA;LU)

BIOMEDICAL RADIOGRAPHY

See also FLUOROSCOPY

Accuracy
Physical aspects of establishing tolerances and limiting values in diagnostic radiology, 15:49659 (RA;GB)

Austria
Methods of measurement, accuracy and tolerable deviations, 15:49665 (RA;GB)

Calibration
Determination of high voltage: Methods of measurement, practicality, accuracy and regulations concerning tolerances, 15:49673 (RA;GB)

Canada
Mandatory quality assurance programmes for diagnostic radiology facilities in Ontario, Canada: Minimum requirements and limiting values, 15:49664 (RA;GB)

Control Systems
A review of automatic exposure control of conventional and digital systems, 15:49672 (RA;GB)
Radiological properties of an automatic exposure control system, 15:49671 (RA;GB)

Dentistry
Quality control of dental X-ray units, 15:49679 (RA;GB)

Federal Republic Of Germany
Proposed limiting values for performance criteria in acceptance testing of diagnostic X-ray equipment in the Federal Republic of Germany, 15:49662 (RA;GB)

Image Processing
Reduction of X-ray film processing variations, 15:49685 (RA;GB)

Images
Film-screen characteristics, 15:49684 (RA;GB)
Sensitometric and densitometric methods for quality control of medical X-ray images, 15:49686 (RA;GB)
The relationship between medical diagnostic requirements and limiting values of technical and physical parameters for image production, 15:49658 (RA;GB)

International Organizations
An overview of the International Electrotechnical Commission's activities on quality assurance in diagnostic radiology, 15:49667 (RA;GB)

Mammary Glands
A phantom for quality control in mammography, 15:49677 (RA;GB)
A protocol for the commissioning and routine testing of mammographic X-ray systems, 15:49675 (RA;GB)
An electronic instrument for high-voltage measurements of an X-ray unit for mammography, 15:49678 (RA;GB)
Report on the use of the Palomex Vision One (Alpha-III) mammographic unit for breast cancer screening, 15:49697 (R;GB)
Report on the use of the Senographe 600TS (SENIXHF) mammographic unit for breast cancer screening, 15:49698 (R;GB)
Screening with mammography - what quality is required and how is it checked?, 15:49676 (RA;GB)

Phantoms
A phantom for quality control in mammography, 15:49677 (RA;GB)
Patient equivalent phantoms in chest radiography, 15:49674 (RA;GB)

Photographic Films
Speed and speed classes of film-screen systems: Determination and practical application, 15:49683 (RA;GB)

Photosensitivity
Speed and speed classes of film-screen systems: Determination and practical application, 15:49683 (RA;GB)

Quality Assurance
A protocol for the commissioning and routine testing of mammographic X-ray systems, 15:49675 (RA;GB)
A review of automatic exposure control of conventional and digital systems, 15:49672 (RA;GB)
An overview of the International Electrotechnical Commission's activities on quality assurance in diagnostic radiology, 15:49667 (RA;GB)
Film-screen characteristics, 15:49684 (RA;GB)
Mandatory quality assurance programmes for diagnostic radiology facilities in Ontario, Canada: Minimum requirements and limiting values, 15:49664 (RA;GB)
Procuring, maintaining and using equipment: the key issues in controlling exposure to patients, 15:49661 (RA;GB)
Proposed limiting values for performance criteria in acceptance testing of diagnostic X-ray equipment in the Federal Republic of Germany, 15:49662 (RA;GB)
Quality assurance and the World Health Organization initiative of 'Health for All' (Diagnostic radiology.), 15:49666 (RA;GB)
Radiological properties of an automatic exposure control system, 15:49671 (RA;GB)
Reduction of X-ray film processing variations, 15:49685 (RA;GB)
Screening with mammography - what quality is required and how is it checked?, 15:49676 (RA;GB)
The Northern Regional Programme for the acceptance testing of X-ray equipment, 15:49663 (RA;GB)
The relationship between medical diagnostic requirements and limiting values of technical and physical parameters for image production, 15:49658 (RA;GB)

Quality Control
A phantom for quality control in mammography, 15:49677 (RA;GB)
An electronic instrument for high-voltage measurements of an X-ray unit for mammography, 15:49678 (RA;GB)
Methods of measurement, accuracy and tolerable deviations, 15:49665 (RA;GB)
Organizing quality control programmes, 15:49660 (RA;GB)
Physical aspects of establishing tolerances and limiting values in diagnostic radiology, 15:49659 (RA;GB)
Practical aspects of uniformity and intercomparison of quality control tests, 15:49668 (RA;GB)
Quality control of dental X-ray units, 15:49679 (RA;GB)
Sensitometric and densitometric methods for quality control of medical X-ray images, 15:49686 (RA;GB)

Resolution
Methods of measurement, accuracy and tolerable deviations, 15:49665 (RA;GB)

Surface Barrier Detectors
The use of a silicon surface barrier detector for quality assurance in diagnostic radiology, 15:49657 (RA;GB)

United Kingdom
Procuring, maintaining and using equipment: the key issues in controlling exposure to patients, 15:49661 (RA;GB)
The Northern Regional Programme for the acceptance testing of X-ray equipment, 15:49663 (RA;GB)

Who
Quality assurance and the World Health Organization initiative of 'Health for All' (Diagnostic radiology.), 15:49666 (RA;GB)

X-Ray Equipment
An electronic instrument for high-voltage measurements of an X-ray unit for mammography, 15:49678 (RA;GB)
Assessment of a Shimadzu/medical X-ray supplies basic radiographic installation, 15:49694 (R;GB)
Assessment of a Siemens basic radiological installation, 15:49695 (R;GB)
Assessment of the Hitachi Sirius 125 B mobile X-ray Unit at three hospitals, 15:49696 (R;GB)
Field size and centring for conventional X-ray equipment, 15:49670 (RA;GB)
Report on the use of the Palomex Vision One (Alpha-III) mammographic unit for breast cancer screening, 15:49697 (R;GB)
Report on the use of the Senographe 600TS (SENIXHF) mammographic unit for breast cancer screening, 15:49698 (R;GB)

X-Ray Tubes
Determination of high voltage: Methods of measurement, practicality, accuracy and regulations concerning tolerances, 15:49673 (RA;GB)

BIOREACTORS
Anaerobic fluid-bed treatment of coal conversion wastewater: Tenth quarterly technical progress report, November 15, 1988–February 15, 1988, 15:48093 (R;US)

High pressure thermobalance device application to the gasification of char obtained from tropical wood, 15:48433 (RA;LU)
Molecular thermodynamics of aqueous two-phase systems for bioseparations, 15:49158 (RA;US)

BIOTECHNOLOGY
Annual report and summaries of FY 1990 activities, 15:48413 (R;US)
Molecular thermodynamics of aqueous two-phase systems for bioseparations, 15:49158 (RA;US)

BISMUTH GERMANATE DETECTORS
See BGO DETECTORS

BISMUTH OXIDES
Experimental studies of effect of high current pulse electron and carbon ion beams on high temperature Y-Ba-Cu-O, Bi-Ca-Sr-Cu-O superconductors, 15:50078 (R;SU;In Russian)
Microfilamentary $Bi_2Sr_2Ca_1Cu_2O_8$ fibers, 15:48922 (R;US)
Superconducting and structural properties of the $(Ba_{0.6}K_{0.4})(Bi_{1-y}Sb_y)O_3$ system, 15:48910 (R;US)

BLACK HOLES
Thermal Comptonization models for gamma-ray emission from black-hole sources, 15:49846 (BA;US)

BLANKETS (BREEDING)
See BREEDING BLANKETS

BLENDING
See MIXING

BNL
A many particle-tracking detector with drift planes and segmentel cathode readout, 15:49267 (J;US)

BOILERS
Comprehensive report to Congress, Clean Coal Technology Program: Full-scale demonstration of low-NOsub x cell burner retrofit, 15:48501 (R;US)

BOILING WATER COOLED AND MODERATED REACTOR
See BWR TYPE REACTORS

BOREHOLES
Building of a conceptual model at the UE25-c hole complex, 15:48339 (BA;US)

BORIDES
See also YTTRIUM BORIDES
An ionic system with critical point at 44°C, 15:49042 (RA;US)

BORON
Mechanical properties, fracture behavior, and grain-boundary chemistry of B-doped NiAl, 15:48867 (R;US)

BORON 10
Clinical possibilities of neutron capture therapy, 15:49689 (RA;FR)

BORON CARBIDES
Dynamic properties of porous B_4C. Interim report, 15:49389 (R;US)

BORON COMPOUNDS
See also BORIDES
BORON CARBIDES
BORON NITRIDES
Clinical possibilities of neutron capture therapy, 15:49689 (RA;FR)

BORON NITRIDES
Formation and pore structure of boron nitride aerogels, 15:48947 (J;US)
Properties of cubic BN under high pressure and temperature, 15:49079 (RA;US)

BOROSILICATE GLASS
Sintering of spherical glass powder under a uniaxial stress, 15:48984 (J;US)

BOROSILICATES
See BOROSILICATE GLASS

BOSONS
See also GLUONS
MESONS
Baryogenesis in extended inflation. Part 1: Baryogenesis via production and decay of supermassive bosons, 15:49818 (R;GB)
Relativistic massive particle with higher curvatures as a model for description of bosons and fermions, 15:49935 (R;SU)

BOTTOM PARTICLES
See BEAUTY PARTICLES

BOUNDARIES (GRAIN)
See GRAIN BOUNDARIES

BR-2 REACTOR
Radioisotopes production programmes for reactor radioisotopes, 15:48636 (RA;FR)

BRACKISH WATER ECOSYSTEMS
See AQUATIC ECOSYSTEMS

BREAKWATERS
See DAMS

BREASTS
See MAMMARY GLANDS

BREEDING BLANKETS
Irradiation testing for fusion technology. Current programme and future plans of KfK, 15:50170 (RA;FR)

BREMSSTRAHLUNG (MAGNETIC)
See SYNCHROTRON RADIATION

BRINES
Preliminary model of repository chemistry for the Waste Isolation Pilot Plant, 15:48288 (R;US)
The effects of brine contamination on volume change behavior of fine grained soils, 15:48166 (RA;CA)

BRITISH COLUMBIA
A brief introduction to Revelstoke Project, 15:48444 (RA;CA)
A new Frontier Geoscience Project: Chilcotin-Nechako region, central British Columbia, 15:48128 (RA;CA)
Current research, part F. Frontier Geoscience Program. Cordilleran and offshore basins, British Columbia, 15:49735 (R;CA)
Petroleum source rock characteristics of the Tertiary Skonun Formation, Queen Charlotte Islands, Hecate Strait and Queen Charlotte Sound, British Columbia, 15:48126 (RA;CA)
Stratigraphy, organic maturation, and source rock potential of Cretaceous strata in the Chilcotin-Nechako region (Nazko Basin), British Columbia, 15:48127 (RA;CA)
Stratigraphy, sedimentology and petroleum source rock potential of the Georgia Basin, southwest British Columbia and northwest Washington State, 15:48129 (RA;CA)

BRONCHOGENIC CARCINOMA
See CARCINOMAS

BROOKHAVEN AGS
The BNL 200 MeV H^- linac: Performance and upgrades, 15:49239 (R;US)

BROOKHAVEN NATIONAL LABORATORY
See BNL

BROOKHAVEN RHIC
The new conceptual design of snakes and spin rotators in RHIC, 15:49230 (R;US)

BUILDING (MANUFACTURING)
See FABRICATION

BUILDING MATERIALS
See also CEMENTS
CONCRETES
Irradiation testing for fusion technology. Current programme and future plans of KfK, 15:50170 (RA;FR)
Prospects and future utilization, 15:48621 (R;FR;In EN, DE)

BUILDINGS
See also ANIMAL SHELTERS
COMMERCIAL BUILDINGS
CONTAINMENT BUILDINGS
GREENHOUSES
HOSPITALS
PUBLIC BUILDINGS
RESIDENTIAL BUILDINGS
Integration of simulation into building design: The need for a joint approach, 15:48783 (R;US)
The practical challenges of converting end-use data into information, 15:48795 (R;US)

BUILDINGS (CONTAINMENT)
See CONTAINMENT BUILDINGS

BUNCHING (BEAM)
See BEAM BUNCHING

BWR TYPE REACTORS
See also DRESDEN-2 REACTOR
LAGUNA VERDE-1 REACTOR
PEACH BOTTOM-2 REACTOR

Atws
Contribution of Anticipated Transients Without Scram (ATWS) to core melt at United States nuclear power plants, 15:48647 (R;US)

Bibliographies
Overview and comparison of US commercial nuclear power plants: Nuclear power plant system sourcebook, 15:48539 (R;US)

Computerized Simulation
The GRS thermalhydraulic system code ATHLET, 15:48533 (RA;XA)

Containment Buildings
An analysis of containment venting as a severe accident mitigation strategy for the BWR Mark II containment, 15:48670 (J;US)

Corium
The MELTSPREAD-1 computer code for the analysis of transient spreading in containments, 15:48643 (R;US)

Eccs
An intermediate break BWR LOCA test (RUN 991) at ROSA-III: Simulation of ECCS line break LOCA phenomena, 15:48656 (R;JP)

Fuel Rods
Irradiation testing of SIEMENS/KWU LWR fuel in the HFR Petten, 15:48531 (RA;FR)

Gamma Dosimetry
[Reactor dosimetry]: Foreign trip report, August 24, 1990–September 4, 1990, 15:48668 (R;US)

Intergranular Corrosion
BWR [Boiling Water Reactor] Owners Group Intergranular Stress Corrosion Cracking Research Program: Executive summary: Phase 2 (1984–1988): Final report, 15:48528 (R;US)

Meltdown
The MELTSPREAD-1 computer code for the analysis of transient spreading in containments, 15:48643 (R;US)

Neutron Dosimetry
[Reactor dosimetry]: Foreign trip report, August 24, 1990–September 4, 1990, 15:48668 (R;US)

Pressure Vessels
Proceedings of the third International Atomic Energy Agency specialist's meeting on subcritical crack growth: Opening session and Technical session 1, 15:48537 (R;US)
Proceedings of the third International Atomic Energy Agency specialists' meeting on subcritical crack growth: Technical sessions 2, 3, and 4 and Recommendations and conclusions Session 5, 15:48538 (R;US)

Reactor Components
Overview and comparison of US commercial nuclear power plants: Nuclear power plant system sourcebook, 15:48539 (R;US)

Reactor Cooling Systems
Proceedings of the third International Atomic Energy Agency specialist's meeting on subcritical crack growth: Opening session and Technical session 1, 15:48537 (R;US)

Reactor Kinetics
Calculation of BWR [Boiling Water Reactor] limit cycle amplitude using Galerkin's method, 15:48527 (R;US)

Reactor Operation
Licensee Event Report (LER) compilation for month of August 1990: Volume 9, No. 8, 15:48592 (R;US)

Reactor Oscillators
Calculation of BWR [Boiling Water Reactor] limit cycle amplitude using Galerkin's method, 15:48527 (R;US)

Reactor Safety
Inherently safe characteristics of nuclear reactors, 15:48532 (R;FR)

Spent Fuels
Burnup credit feasibility for BWR spent fuel shipments, 15:48526 (R;US)

Stress Corrosion
BWR [Boiling Water Reactor] Owners Group Intergranular Stress Corrosion Cracking Research Program: Executive summary: Phase 2 (1984–1988): Final report, 15:48528 (R;US)

Welded Joints
Fabrication of axial stress corrosion cracks in Alloy 182 weld materials: Final report, 15:48529 (R;US)

C

C-1430 RESONANCES
See MESONS

CADMIUM
Final best demonstrated available technology (BDAT) background document for D006 cadmium wastes. Volume 21, 15:49495 (R;US)
Final response to BDAT related comments document: D005: Characteristic wastes for barium, and P013 and D006: Characteristic wastes for cadmium. Volume 1-F, 15:49521 (R;US)

CADMIUM ALLOYS
Physical metallurgy and magnetic behavior of Cd stabilized bcc (beta)Gd alloys, 15:48881 (R;US)

CADMIUM SULFIDES
Picosecond studies of the electron-hole pair dynamics in CdS_xSe_{1-x} graded semiconductors, 15:48961 (RA;US)

CADMIUM TELLURIDES
Optical characterization of CdZnTe/CdTe strained quantum wells, 15:48978 (R;US)

CAES
See COMPRESSED AIR ENERGY STORAGE

CALCIUM
Retention of alkaline earth elements in man: Final report for the period 1 April 1986 - 14 May 1989, 15:49712 (R;XA)

CALCIUM 40 TARGET
Complex fragment emission in binary and multifragment decay of very hot nuclear systems, 15:50001 (R;US)

CALCIUM COMPOUNDS
See also CALCIUM OXIDES
CALCIUM SULFATES
CALCIUM SULFIDES
Formation of calcium and magnesium molybdate complexes in dilute aqueous solutions and evaluation of powellite solubility in spent oil shale, 15:48202 (R;US)

CALCIUM FLUORIDES
See also FLUORITE
Stress versus temperature dependent activation energies in creep, 15:48852 (R;US)

CALCIUM OXIDES
Development of high-Tc superconducting wire with high critical current density, 15:48935 (R;JP)
Microfilamentary $Bi_2Sr_2Ca_1Cu_2O_8$ fibers, 15:48922 (R;US)
Preparation and structural characterization of Tl-Sr-Ca-Cu-O superconducting materials, 15:48934 (R;JP)
Reaction kinetics of the $CaO-SO_2$ system in absence of intergrain pore diffusion: Annual report, 15:48108 (R;US)

CALCIUM SULFATES
See also GYPSUM
Effect of calcium sulfate on pool boiling of enhanced heat transfer surfaces, 15:49180 (R;US)
Final treatment standards for K069 nonwaste waters in the calcium sulfate/sodium subcategory and waste-water forms of K069. Volume 11. Memorandum report, 15:49485 (R;US)

CALCIUM SULFIDES
A study of the thermoelectric properties of Ca, Sr and Hg substituted lanthanum sulfides, 15:48956 (R;US)

CALCULATIONS (COMPUTER)
See COMPUTER CALCULATIONS

CALIBRATION STANDARDS
Simulation of alpha continuous air monitor alarm response in the presence of plutonium, 15:49557 (R;US)
The preparation of synthetic fusion standards for use in the x-ray-fluorescence analysis of rocks and minerals, 15:49024 (R;ZA)

CALIFORNIA
Health assessment for GBF, Inc., Dump, Antioch, Contra Costa County, California, Region 9. CERCLIS No. CAD980498562. Preliminary report, 15:49620 (R;US)
Health assessment for Intersil, Inc./Siemens Components, Cupertino, Santa Clara County, California, Region 9. CERCLIS No. CAD041472341. Preliminary report, 15:49627 (R;US)

CALORIMETERS (PARTICLE)
See SHOWER COUNTERS

CAM
See COMPUTER-AIDED MANUFACTURING

CAMAC SYSTEM
A versatile, programmable control and data acquisition system for complex integrated circuits, 15:49332 (J;US)

CAMERAS
See also GAMMA CAMERAS
The optical parametrization of an aerial multispectral camera, 15:49599 (R;FI)

CANADA
See also ALBERTA
BRITISH COLUMBIA
MANITOBA
NEW BRUNSWICK
NORTHWEST TERRITORIES
NOVA SCOTIA
ONTARIO
PRINCE EDWARD ISLAND
QUEBEC
SASKATCHEWAN
YUKON TERRITORY

Air Pollution
Technical committee for the long-range transport of atmospheric pollutants in western and northern Canada: Annual report, 1987, 15:49467 (R;CA)

Biomass
Biomass pyrolysis technology and products. A Canadian viewpoint, 15:48420 (RA;LU)

Demonstration Programs
The Federal Energy R&D Program: Putting imagination to work, 15:48766 (R;CA)

Energy Source Development
Environmental Studies Research Funds annual report, 1989, 15:48747 (R;CA)

Environmental Policy
Environmental data bases for State of the Environment reporting: Conservation and Protection Headquarters. Technical Report Series No. 9, 15:48704 (R;CA)
Organizational and spatial frameworks for state of the environment reporting, 15:48703 (R;CA)

Fossil-Fuel Power Plants
Metallurgical investigation of main-steam-line weldment cracking, Lakeview TGS, 15:48493 (R;CA)

Hydroelectric Power Plants
Hydroelectric installations: A priceless heritage, 15:48445 (RA;CA)

Natural Gas Distribution Systems
Pressure history of a gas pipeline, 15:48189 (R;CA)
Reasons for decision [in the matter of a] rewiew of the applications for gas export licences from Direct Energy Marketing Limited, Indeck Gas Supply Corporation, Shell Canada Limited and Western Gas Marketing Limited as agent for TransCanada PipeLines Limited, 15:48187 (R;CA)
Reasons for decision [in the matter of a] rewiew of the applications for gas export licences from Direct Energy Marketing Limited, Indeck Gas Supply Corporation, Shell Canada Limited and Western Gas Marketing Limited as agent for TransCanada PipeLines Limited, 15:48188 (R;CA)

Oil Spills
Maritime Pollution Claims Fund annual report, 1988-1989, 15:48165 (R;CA)

Petroleum Industry
Canadian petroleum industry: 1989 monitoring report. First six months, 15:48143 (R;CA)
Oil spill preparedness in the upstream petroleum industry, 15:48153 (R;CA)
Oil-spill preparedness in the upstream petroleum industry, 15:48152 (R;CA)

Power Systems
Electrical power sources inventory for Transport Canada, 15:48755 (R;CA)

Regional Analysis
Modeled sulfur deposition trends since 1990 in North America, 15:49456 (R;US)
Summary of the NAPAP state of science report on deposition monitoring in North America, 1979–1987, 15:49457 (R;US)

Reporting Requirements
Environmental data bases for State of the Environment reporting: Conservation and Protection Headquarters. Technical Report Series No. 9, 15:48704 (R;CA)
Organizational and spatial frameworks for state of the environment reporting, 15:48703 (R;CA)

Research Programs
Environmental Studies Research Funds annual report, 1989, 15:48747 (R;CA)
The Federal Energy R&D Program: Putting imagination to work, 15:48766 (R;CA)

Underground Mining
Review and evaluation of main roadway intersection techniques for use in the Sydney coal field, 15:48102 (R;CA)

CANDU TYPE REACTORS
Assessment of the iron-based, stressed-shell container, 15:48286 (R;CA)
Low enriched uranium fuel in CANDU reactors, 15:48252 (RA;XA)
Wind force measurement on a model fuelling-machine trolley in a simulated LOCA, 15:48661 (R;CA)

CANINES
See DOGS

CANISTERS
See CONTAINERS

CANONICAL EQUATIONS
See DIFFERENTIAL EQUATIONS

CAPACITORS
A 4096 cell switched capacitor analog waveform storage integrated circuit, 15:48686 (J;US)

CARBINOL
See METHANOL

CARBON
See also CARBON BLACK
GRAPHITE
Damped-core quantum Monte Carlo: An effective treatment for large-z systems, 15:50233 (RA;US)

CARBON 12 BEAMS
Monitoring system for relativistic particles and nuclei, 15:49260 (R;SU)

CARBON 12 TARGET
Complex fragment emission in binary and multifragment decay of very hot nuclear systems, 15:50001 (R;US)
Cross section and analyzing power for quasifree (p,n) reactions, 15:50000 (R;US)
Search for strangeness-abundant quark-gluon matter in nucleus-nucleus and antiproton-nucleus interactions, 15:50042 (R;SU;In Russian)

CARBON 14
Oceanic CO_2 uptake and future atmospheric CO_2 concentrations, 15:49589 (R;US)
Risk perspective on potential releases of ^{14}C from the geologic repository at Yucca Mountain, 15:48384 (BA;US)

CARBON BLACK
Electrode kinetics and electrocatalysis, 15:48840 (RA;US)
The corrosion of carbon black anodes in alkaline electrolyte: IV. Current efficiencies for oxygen evolution from metal oxide-impregnated graphitized furnace blacks, 15:49104 (RA;US)

CARBON DIOXIDE
Biological sources and sinks of methane in tropical habitats and tropical atmospheric chemistry. Doctoral thesis, 15:49532 (R;US)

Oceanic CO_2 uptake and future atmospheric CO_2 concentrations, 15:49589 (R;US)
Report of the Expert Group on Emissions Scenarios of the Response Strategies Working Group of the Intergovernmental Panel on Climate Change. Technical draft report, 15:49541 (R;US)
Survey for impacts of global environmental issues on utilizations of alternative energies for oil, 15:49469 (R;JP;In Japanese)
Survey on solidification and utilization technology of CO_2, 15:49468 (R;JP;In Japanese)

CARBON DIOXIDE FIXATION
Survey on solidification and utilization technology of CO_2, 15:49468 (R;JP;In Japanese)

CARBON DIOXIDE LASERS
A compact, rugged, high repetition rate CO_2 laser incorporating catalyst, 15:49212 (RA;US)
Pulsed-discharge carbon dioxide lasers, 15:49211 (RA;US)
The e-beam sustained CO_2 laser amplifier, 15:49213 (RA;US)

CARBON FIBERS
Metal-matrix composites - a promising alternative to conventional alloys, 15:48908 (R;DE)

CARBON MONOXIDE
Observation of correlation effects in zero kinetic energy electron spectra near the N1s and C1s thresholds in N_2, CO, C_6H_6, and C_2H_4, 15:49131 (RA;US)

CARBON STARS
IR spectrophotometry of bright carbon stars, 15:49785 (RA;FR)

CARBON TETRACHLORIDE
Collisional and electric-field ionization of laser-prepared Rydberg states in an ion trap mass spectrometer, 15:49872 (R;US)
Performance evaluation of a groundwater and soil gas remedial action, 15:49566 (R;US)

CARBONATES
See also LEAD CARBONATES
The chemistry of plutonium(VI) in aqueous carbonate solutions, 15:49033 (R;US)

CARBONYLS
Infrared flash kinetic spectroscopy of transients generated by irradiation of $(\eta^5\text{-}C_5H_5)Co(CO)_2$ in the gas phase and in solution, 15:49003 (RA;US)

CARCINOMAS
Results and hazards of postoperative radiotherapy using orthovoltage (300 kV) in carcinomas of the breast, 15:49690 (R;DE;In German)
The role of CT in follow-up treatment of patients after proctectomy due to a carcinoma: A retrospective study of 93 patients, 15:49691 (R;DE;In German)

CARIBOU
See DEER

CARS SPECTROSCOPY
See RAMAN SPECTROSCOPY

CAST IRON
A program to qualify ductile cast iron for use as a containment material for Type B transport cask, 15:49165 (R;US)

CASTOR TOKAMAK
A 40 keV neutral lithium beam source for tokamak CASTOR, 15:49876 (RA;CS)
A method for determination of the electron temperature from Langmuir probe data in a tokamak edge plasma, 15:50149 (RA;CS)
A time-of-flight analyzer of low energy atoms (preliminary test on the CASTOR tokamak), 15:50143 (RA;CS)
Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak", 15:50133 (R;CS;In Russian, English)

CATALYSTS
See also ELECTROCATALYSTS
Manufacture of air electrodes and long run tests, 15:48763 (R;FI)
Potentially catalytic and conducting polyorganometallics, 15:49052 (RA;US)

CATHODES
Cold fusion and tritium, 15:50199 (RA;GB)
Corrosion and arc erosion in MHD channels: Quarterly progress report, January–March 1990, 15:48757 (R;US)
The non-observation of cold nuclear fusion in electrolytic cells stimulated by high intensity stopped muons and pions, 15:50198 (RA;GB)

CAUCHY PROBLEM
On integrating of a singular integro-differential equation, 15:50096 (R;SU;In Russian)

CAVITIES
See also BOREHOLES
Fluid flow and mass transport in small cavities, 15:49108 (RA;US)

CDF
Design and prototyping of the front end readout system for the CDF silicon vertex detector, 15:49273 (J;US)
Neural networks for triggering, 15:49269 (J;US)
Use of fiber-optics for real-time control and data acquisition, 15:49270 (J;US)

CELL FLOW SYSTEMS
A clinical flow cytometry data analysis assistant, 15:49651 (R;US)

CELLS (BACTERIAL)
See BACTERIA

CELLULOSE
Preliminary model of repository chemistry for the Waste Isolation Pilot Plant, 15:48288 (R;US)

CEMENTS
Modified sulphur cement: A low porosity encapsulation material for low, medium and alpha waste, 15:48274 (R;FR)

CENTRAL NERVOUS SYSTEM
Nuclear medicine and imaging research (quantitative studies in radiopharmaceutical science): Progress report, January 1–September 1, 1990, 15:49688 (R;US)

CENTRAL REGION
See FEDERAL REGION III

CERAMICS
Bose-condensation in limited two-dimensional systems and the critical temperatures of superconducting ceramics, 15:48925 (R;UA;In Russian)
Characterizing closure asperities by ultrasonic measurements, 15:48919 (R;US)
Theory of ceramic/zirconia composites: Toughening, strengthening, and synergism, 15:48904 (R;US)
Thermal and laser assisted conversion of metallo-organic precursors to ceramic materials, 15:48936 (BA;US)
[Mechanical behavior of ceramics and composites]: Foreign trip report, August 2, 1990–August 22, 1990, 15:48933 (R;US)

CEREBRUM
3-D phantom to simulate cerebral blood flow and metabolic images for PET, 15:49701 (J;US)

CERIUM 142
Microscopic description of neutron and proton transition moments in spherical nuclei, 15:50037 (RA;SU)

CERIUM COMPLEXES
On the stability and bonding in bis(η-arene)lanthanide complexes, 15:49063 (RA;US)

CERIUM IONS
Anomalously small 4f-5d oscillator strengths and 4f-4f electronic Raman scattering cross sections for Ce^{3+} in crystals of $LuPO_4$, 15:49022 (RA;US)
Intensities of electronic Raman scattering between crystal-field levels of Ce^{3+} in $LuPO_4$: Nonresonant and near resonant excitation, 15:49023 (RA;US)

CERIUM OXIDES
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 8, April 1, 1989–June 30, 1989, 15:48510 (R;US)

CESIUM 137
Analysis method of fractional release of cesium from fuel elements of HTTR, 15:48630 (R;JP;In Japanese)
Radioactivity survey data in Japan, part 1: Environmental materials, 15:49603 (R;JP)
Radioactivity survey data in Japan, part 2: Dietary materials, 15:49705 (R;JP)
US Mussel Watch Program: Transuranic element data from Woods Hole Oceanographic Institution 1976-1983. Technical report, 15:49610 (R;US)

CESIUM IODIDES
Optical and mechanical properties of hot-pressed cesium iodide, 15:48941 (J;US)
Readout techniques and radiation damage of undoped cesium iodide, 15:48940 (J;US)
CESIUM SULFATES
Muon spin relaxation study of protonic superionic conductor $CsHSO_4$, 15:50079 (R;SU)
CHARCOAL
Advanced vacuum pyrolysis project: State of the art and perspectives, 15:48421 (RA;LU)
Alten activities in the field of biomass exploitation for energetic uses, 15:48429 (RA;LU)
Development of charcoal making processes in France, 15:48424 (RA;LU)
High pressure thermobalance device application to the gasification of char obtained from tropical wood, 15:48433 (RA;LU)
CHARGED PARTICLES
See also ALPHA PARTICLES
DEUTERONS
IONS
TRITONS
On energy dependence of the width and shape of the rapidity distribution of negatively charged particles, 15:49927 (R;SU;In Russian)
CHARGED-PARTICLE ACTIVATION
See CHARGED PARTICLES
CHARGED-PARTICLE TRANSPORT THEORY
About applicability of binary collisions model in the theory of ion transport in matter, 15:50059 (RA;SU;In Russian)
CHARGING MACHINES (REACTOR)
See REACTOR CHARGING MACHINES
CHARM PARTICLES
Charm physics in B factory, 15:49309 (RA;JP;In Japanese)
Sensitivity of angular distribution of high energy muon flux from atmosphere to hadron charm production parameters, 15:49955 (RA;SU;In Russian)
CHARMONIUM
Massive straight-line string as a model of heavy quarkonium, 15:49932 (R;SU;In Russian)
CHARPAK CHAMBERS
See MULTIWIRE PROPORTIONAL CHAMBERS
CHELATING AGENTS
See also EDTA
Complexation of lanthanide(III) ions by catechol and similar ligands, 15:49059 (RA;US)
Kinetically inert lanthanide amine complexes, 15:49005 (RA;US)
CHEMICAL ANALYSIS
Spectrographic determination of impurities in high-purity tantalum oxide and niobium oxide, 15:49081 (R;ZA)
CHEMICAL BONDS
Formation and stability of As-H bonds in H-implanted GaAs, 15:49083 (R;US)
Tunable far-infrared laser spectroscopy of hydrogen bonds: The $K_a = O(u) \rightarrow 1$ (g) rotation-tunneling spectrum of the HCl dimer, 15:49048 (RA;US)
CHEMICAL ENGINEERING
Work in progress, 15:49072 (RA;US)
CHEMICAL INDUSTRY
Best demonstrated available technology (BDAT) background document for U and P wastes and multi-source leachate (F039). Volume E. Gaseous U and P wastes. Final report, 15:49514 (R;US)
CHEMICAL REACTIONS
See also DENITRIFICATION
DESULFURIZATION
SULFIDATION
Quantum mechanical and semiclassical studies of tunneling in hydrogen atom transfer reactions and processes involving hydrogen on metal surfaces, 15:49086 (BA;US)
CHEMICAL REACTORS
Consolidated fuel reprocessing program simulation of a continuous rotary dissolver, 15:48226 (BA;US)
Selective steam cracking for energy and raw materials savings: Final report, 15:48137 (R;LU)
Simultaneous particulates NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 2, October 1, 1987–December 31, 1987, 15:48504 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 5, July 1, 1988–September 30, 1988, 15:48507 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 6, October 1, 1988–December 31, 1988, 15:48508 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemcial technology: Technical progress report No. 7, January 1, 1989–March 31, 1989, 15:48509 (R;US)
CHEMICAL SPILLS
Calculating toxic corridors. Revision. Technical report, 15:49415 (R;US)
Emergency response notification system, 15:48158 (R;US)
CHEMICAL WARFARE AGENTS
Analysis of soil samples for chemical warfare agents: Canadian contribution to a multinational round-robin analytical exercise. Memorandum report, 15:49409 (R;US)
Application of high-frequency ventilation to treatment of chemical-warfare casualties: Animal and theoretical studies (application of high-frequency transtracheal jet ventilation to treatment of chemical-warfare casualties). Final report, March 1983-December 1986, 15:49410 (R;US)
Application of high-frequency ventilation to treatment of chemical-warfare casualties: Animal and theoretical studies. Annual report, 1 March 1984-28 February 1985, 15:49411 (R;US)
Chemical weapons proliferation in the Middle East: What is the proper response. Study project, 15:48849 (R;US)
Laser-induced IR fluorescence spectra of simulant chemical threat agent and exhaust vapors. Technical report, 15:49408 (R;US)
CHEMISTRY
See also ATMOSPHERIC CHEMISTRY
ELECTROCHEMISTRY
PHOTOCHEMISTRY
PHYSICAL CHEMISTRY
RADIOCHEMISTRY
Proceedings of 6. Latin American School on Theoretical Chemistry. v.1, 15:48986 (R;BR;In Portuguese)
Upgrading user interfaces to computational chemistry codes, 15:48987 (R;US)
CHERENKOV COUNTERS
A programmable multichannel correlation module for analyzing neutron multiplicities, 15:49337 (J;US)
Application of the high-current wire photodetector for Cherenkov radiation ring detecting: Recent progress and future development, 15:49297 (R;SU;In Russian)
Construction and testing of the SLD Cerenkov ring imaging detector, 15:49359 (J;US)
CHERENKOV DETECTORS
See CHERENKOV COUNTERS
CHERNOBYLSK-4 REACTOR
Information on economic and social consequences of the Chernobyl accident, 15:48652 (R;XA)
Radioactivity measurements in Europe after the Chernobyl accident: Part I: Air, 15:48648 (R;FR)
CHI RESONANCES
See MESONS
CHI-2800 RESONANCES
See MESONS
CHI-3455 RESONANCES
See MESONS
CHINESE HAMSTER OVARY CELLS
See CHO CELLS
CHIRAL SYMMETRY
Chiral interface at the finite temperature transition point of QCD, 15:50048 (R;US)

CHLOR-ALKALI INDUSTRY
See CHEMICAL INDUSTRY
CHLORINE

CHLORINATED ALIPHATIC HYDROCARBONS
See also CARBON TETRACHLORIDE
CHLOROFORM
PVC
Amendment to the final best demonstrated available technology (BDAT) background document for wastes from the production of chlorinated aliphatic hydrocarbons F024. Final report, 15:49513 (R;US)
Amendment to the final best demonstrated available technology (BDAT) background document for wastes from the production of 1,1,1-trichloroethane K028, K029, K095, and K096. Final report, 15:49502 (R;US)
Best demonstrated available technology (BDAT) background document for wastes from the production of chlorinated aliphatics F025. Volume 1. Final report, 15:49499 (R;US)
Final response to BDAT related comments document. F025, K002-K008, K011, K013-15, K046, K061, K069. volume 1-k, 15:49526 (R;US)
Final response to BDAT related comments document. K017/K028-K029, K095-096, K022, K025, K035, K026, K083, K024. Volume 1-M, 15:49527 (R;US)
Gas-phase chemical reactivity of CFC-114 [Chloro-fluoro-carbons-114] and potential replacements: Part 1, CFC-114 reactivity with Fsub 2 and UFsub 6, 15:48216 (R;US)
Health assessment for Recticon/Allied Steel Corporation, Parkerford, Chester County, Pennsylvania, Region 3. CERCLIS No. PAD053302865. Preliminary report, 15:49533 (R;US)

CHLORINATED AROMATIC HYDROCARBONS
Best demonstrated available technology (BDAT) background document for halogenated pesticide and chlorobenzene wastes K032-K034, K041, K042, K085, K097, K098, K105, D012-D017. Final report, 15:49512 (R;US)
Dynamics of endoergic substitution reactions: I. Br + chlorinated aromatic compounds, 15:49882 (RA;US)
Report of the PCB Working Group, 15:49576 (R;CA)
Superfund Record of Decision (EPA Region 2): Roebling Steel, NJ. (First remedial action), March 1990, 15:49631 (R;US)
Task order enhanced preliminary assessment, New Orleans Military Ocean Terminal, New Orleans, Louisiana. Final report, October-December 1989, 15:49417 (R;US)

CHLORINE
Determination of non-metallic elements in actinide complexes by oxygen flask combustion (OFC): chlorine and fluorine, 15:48989 (R;IN)
Direct measurement of the absolute kinetics of chlorine atom in CCl_4, 15:49093 (BA;US)

CHLORINE CHLORIDES
See CHLORINE

CHLORINE COMPOUNDS
Evaluation of room-temperature chloroaluminate molten salts as electrolytes for high energy density batteries. Final report, June 1988-April 1990, 15:48691 (R;US)

CHLORINE LOGS
See NEUTRON-GAMMA LOGGING

CHLOROBUTADIENE
See NEOPRENE

CHLOROFORM
Performance evaluation of a groundwater and soil gas remedial action, 15:49566 (R;US)

CHLOROPRENE
See NEOPRENE

CHO CELLS
Survival of Chinese hamster ovary cells following ultrahigh-dose-rate electron and bremsstrahlung radiation. Final report, September 1988-February 1989, 15:49707 (R;US)

CHROMATID DELETIONS
See CHROMOSOMAL ABERRATIONS

CHROMATOGRAPHY
Miniaturized chromatographic radiochemical procedure for ^{131}I-MIBG, 15:49148 (R;BR)
Progress in the theory of non-linear chromatography, 15:49026 (BA;US)

CHROMIUM
Consistency of microscopic evaluations and integral experiments for chromium, iron and nickel, 15:50009 (R;XA)
Final best demonstrated available technology (BDAT) background document for chromium wastes D007 and U032. Volume 22, 15:49496 (R;US)
Final response to BDAT related comments document. D007. Characteristic wastes for chromium. Volume 1-G, 15:49522 (R;US)

CHROMIUM 50
Neutron-proton ratios of collective quadrupole matrix elements in even Fe and Cr isotopes, 15:50040 (R;SU)

CHROMIUM 52
Neutron-proton ratios of collective quadrupole matrix elements in even Fe and Cr isotopes, 15:50040 (R;SU)

CHROMIUM 54
Neutron-proton ratios of collective quadrupole matrix elements in even Fe and Cr isotopes, 15:50040 (R;SU)

CHROMIUM ALLOYS
See also ALLOY-FE44NI33CR21
CHROMIUM STEELS
The interaction of point defects with line dislocations in HVEM [high voltage electron microscope] irradiated Fe-Ni-Cr alloys, 15:48862 (R;US)

CHROMIUM COMPOUNDS
See also CHROMIUM OXIDES
Oxidation of chromium(II) by hydroxylamine-O-sulfonic acid, 15:49034 (R;US)

CHROMIUM OXIDES
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 9, July 1, 1989–September 30, 1989, 15:48511 (R;US)

CHROMIUM STEELS
See also STEEL-CR12MOV
STEEL-CR9MONBV
The erosion-corrosion of modified chromium steels, 15:48119 (RA;US)

CHROMIUM-NICKEL-MOLYBDENUM STEELS
See also STEEL-CR17NI12MO3-L
Thermophysical and thermochemical properties of fast reactor materials, 15:48872 (R;FR)

CHROMODYNAMICS
See QUANTUM CHROMODYNAMICS

CHROMOSOMAL ABERRATIONS
Correlation of chromosome patterns in leukemic cells of patients with exposure to chemicals and/or radiation: Progress report, January 1–August 20, 1990, 15:49655 (R;US)

CHROMOSOME ABERRATIONS
See CHROMOSOMAL ABERRATIONS

CHROMOSOME EXCHANGES
See CHROMOSOMAL ABERRATIONS

CHROMOSOME FRAGMENTS
See CHROMOSOMAL ABERRATIONS

CIRCUITS (ELECTRONIC)
See ELECTRONIC CIRCUITS

CITIES
See URBAN AREAS

CLAYS
A desk study of surface diffusion and mass transport in clay, 15:48276 (R;FR)

CLIMATES
Ecological characterization atlas of coastal Alabama: Map narrative, 15:49571 (R;US)
Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 1: Final report, 15:48774 (R;CA)
Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 5: Final report, 15:48778 (R;CA)
Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 2: Final report, 15:48775 (R;CA)
Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 4: Final report, 15:48777 (R;CA)

Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 3: Final report, 15:48776 (R;CA)
Report of the Expert Group on Emissions Scenarios of the Response Strategies Working Group of the Intergovernmental Panel on Climate Change. Technical draft report, 15:49541 (R;US)
Report of the Expert Group on Emissions Scenarios of the Response Strategies Working Group of the Intergovernmental Panel on Climate Change. Appendix. Technical report (Draft), 15:49542 (R;US)

CLOUDS
The role of clouds and precipitation in the long-range transport of air pollutants and acid rain formation in Canada: Phase 2. Programming, testing and refining of cloud dynamics, microphysics and chemistry models, 15:49473 (R;CA)

CLUSTERS (SOLID)
See SOLID CLUSTERS

COAL
Cleaning
Open-gradient magnetic separation for physical coal cleaning: Results for Pittsburgh No. 8 and Upper Freeport coals, 15:48071 (R;US)

Cocombustion
Co-firing of natural gas and coal. Annual report, October 1988-September 1989, 15:48121 (R;US)
Testing of New Brunswick oil shale in R.P.C. test facility. Open File Report No. 90-2, 15:48199 (R;CA)

Combustion
Artificial intelligence in process control, 15:48110 (RA;US)
Atmospheric fates of air pollutants, 15:49551 (RA;FI)

Combustion Kinetics
Co-firing of natural gas and coal. Annual report, October 1988-September 1989, 15:48121 (R;US)

Combustion Products
Deposition, corrosion, erosion and sulfur emission studies related to coal combustion: Annual report, 15:48109 (R;US)

Coprocessing
Exploratory coprocessing research: Quarterly report No. 7, March 1, 1990–May 31, 1990, 15:48077 (R;US)
Stable carbon isotope analysis of coprocessing materials: Quarterly technical progress report, July 1–September 30, 1989, 15:48076 (R;US)

Desulfurization
Assessment of physical coal-cleaning practices for sulfur removal. Final report, April 1986-January 1990, 15:48073 (R;US)
Bioprocessing of coal. 1.: Microorganisms for coal processing, 15:48074 (R;JP;In Japanese)

Evaluation
Iowa State Mining and Mineral Resources Research Institute: Semi-annual report, July 1, 1989–December 31, 1989, 15:49738 (R;US)

Flotation
In-plant testing of microbubble column flotation: Technical progress report second quarter, January 1, 1990–March 31, 1990, 15:48072 (R;US)

Liquefaction
Bioprocessing of coal. 1.: Microorganisms for coal processing, 15:48074 (R;JP;In Japanese)

Materials Handling
Coal handleability: Addressing the concerns of the electric utility industry, 15:48104 (R;US)

Methanogenic Bacteria
Bioprocessing of coal. 1.: Microorganisms for coal processing, 15:48074 (R;JP;In Japanese)

Phase Studies
Microcharacterization of coal components for beneficiation: Fossil energy quarterly report, April 1, 1989–June 30, 1989, 15:48087 (R;US)

Slurries
Bioprocessing of coal. 1.: Microorganisms for coal processing, 15:48074 (R;JP;In Japanese)

Structural Chemical Analysis
^{31}P NMR analysis of coal moieties bearing -OH, -NH and -SH functions: Quarterly report, April 1, 1990–June 30, 1990, 15:48086 (R;US)

Sulfur
Bioprocessing of coal. 1.: Microorganisms for coal processing, 15:48074 (R;JP;In Japanese)

Sulfur-Oxidizing Bacteria
Bioprocessing of coal. 1.: Microorganisms for coal processing, 15:48074 (R;JP;In Japanese)

Surface Properties
Chemical characterization of the surface sites of coal: Technical progress report, April–June 1990, 15:48085 (R;US)
Chemical characterization of the surface sites of coal: Technical progress report, April–June 1989, 15:48084 (R;US)
Flotation and flocculation chemistry of coal and oxidized coals: Technical progress report, March 15, 1990–June 14, 1990, 15:48083 (R;US)
Measurement and control of coal hydrophobicity, 15:48088 (R;US)

COAL DEPOSITS
Geotechnical study of rock-mass classification parameters for Sydney coal field, Nova Scotia, 15:48100 (R;CA)

COAL GASIFICATION
Anaerobic fluid-bed treatment of coal conversion wastewater: Tenth quarterly technical progress report, November 15, 1988–February 15, 1988, 15:48093 (R;US)
Catalysis of carbon gasification: Influence of different modes of addition of catalysts. Annual report, January 1989-January 1990, 15:48081 (R;US)

COAL GASIFICATION PLANTS
Advanced wastewater treatment, 15:48092 (RA;US)

COAL LIQUEFACTION
Anaerobic fluid-bed treatment of coal conversion wastewater: Tenth quarterly technical progress report, November 15, 1988–February 15, 1988, 15:48093 (R;US)
Methods for producing liquid hydrocarbons from coal, 15:48080 (R;CA)

COAL LIQUEFACTION PLANTS
Advanced wastewater treatment, 15:48092 (RA;US)

COAL MINING
Alluvial valley floor identification and study guidelines. Final report, 15:48103 (R;US)
Plains hydrology and reclamation project: Spoil ground-water chemistry and its impacts on surface water, 15:48098 (R;CA)

COAL PREPARATION
Assessment of physical coal-cleaning practices for sulfur removal. Final report, April 1986-January 1990, 15:48073 (R;US)
High pressure NMR spectroscopy studies: The regioselective hydrogenation mechanism of polynuclear heteroaromatic nitrogen compounds with $Cp^*Rh(CH_3CN)_3^{2+}$ as a catalyst precursor, 15:48082 (BA;US)

COAL PREPARATION PLANTS
Experimental studies of the production of lightweight aggregate from fly ash/coal cleaning refuse mixtures, 15:48094 (R;US)
In-plant testing of microbubble column flotation: Technical progress report second quarter, January 1, 1990–March 31, 1990, 15:48072 (R;US)

COAL-OIL MIXTURES
See COAL

COASTAL REGIONS
Coastal reforestation and agroforestry as immediate ameliorative measures to address global warming and to promote sustainable habitation of low-lying and coastal areas, 15:49435 (RA;US)
Ecological characterization atlas of coastal Alabama: Map narrative, 15:49571 (R;US)
Texas Barrier Islands Region ecological characterization atlas: Biological resources narrative, 15:49570 (R;US)
Texas Barrier Islands Region ecological characterization atlas: Socioeconomic and natural features narrative, 15:49569 (R;US)

COATED FUEL PARTICLES
HTR components irradiation tests. Actual state and future requirements, 15:48634 (RA;FR;In German)
COBALT
Catalytic treatment of pyrolysis oils, 15:48435 (R;LU)
Improved Fischer-Tropsch Synthesis catalysts for indirect coal liquefaction: Quarterly technical progress report No. 8, 1 July–30 September 1987, 15:48075 (R;US)
COBALT 60
Radioisotopes production programmes for reactor radioisotopes, 15:48636 (RA;FR)
COBALT ALLOYS
See also ALLOY-FE44NI33CR21
An apparatus for studies of hydrogen isotope exchange over metals using laser-Raman spectroscopy, 15:48998 (R;US)
Study on the fracturing of cermets in the tungsten monocarbide-cobalt system during microimpact loading, 15:48926 (R;UA;In Russian)
COBALT COMPLEXES
Infrared flash kinetic spectroscopy of transients generated by irradiation of $(\eta^5\text{-}C_5H_5)Co(CO)_2$ in the gas phase and in solution, 15:49003 (RA;US)
COBALT OXIDES
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 9, July 1, 1989–September 30, 1989, 15:48511 (R;US)
COGENERATION PLANTS
See DUAL-PURPOSE POWER PLANTS
COHERENT ANTI-STOKES RAMAN SPECTROSCOPY
See RAMAN SPECTROSCOPY
COLD NEUTRONS
Cold neutron source as heat pipe, 15:49182 (RA;JP;In Japanese)
COLD STORAGE
Economics of cool storage for Bell Northern Research Lab 5, Ottawa, Ontario, and a comparison of chilled water with three types of ice storage modules, 15:48779 (R;CA)
Report to Dept. of Supply and Services on the economics of cool storage for Bell Northern Research Lab 5, Ottawa, Ontario and a comparison of chilled water with three types of ice-storage modules, 15:48688 (R;CA)
COLLECTIVE MODEL
Nuclear spectroscopy and quantum chaos, 15:50031 (R;JP)
COLLIDER DETECTOR AT FERMILAB
See CDF
COLLISIONAL PLASMA
Statistical simulation of Coulomb collisions in a plasma, 15:50131 (R;SU;In Russian)
COLOGNE SPIRITS
See ETHANOL
COLORADO
The results and politics of oxygenated fuels in Colorado, 15:48844 (RA;CA)
COLUMBIUM
See NIOBIUM
COMBINED GAS AND STEAM CYCLE POWER PLANTS
See COMBINED-CYCLE POWER PLANTS
COMBINED-CYCLE POWER PLANTS
Assessment of modular IGCC plants based on entrained flow coal gasification supplemental studies, 15:48489 (R;US)
Environmental review of Potomac Electric Power Company's proposed Station H Element I, 15:48155 (R;US)
Research and development of advanced gas turbine. Technical report, 15:48495 (R;JP)
COMBUSTION
Optical measuring methods, 15:49554 (RA;FI)
Particle emissions, 15:49549 (R;FI)
Size distribution measurement of particles in flue gases, 15:49550 (RA;FI)
The combustion of liquid fuels, 15:48176 (R;GB)
The theory and technics of particle measuring methods: Controlling measurements. Dust, 15:49556 (RA;FI)
COMBUSTION CHAMBERS
Combustor design and analysis using the Rocket Combustor Interactive Design (ROCCID) methodology, 15:49193 (R;US)
Introducing the VRT gas turbine combustor, 15:49192 (R;US)
COMBUSTION PRODUCTS
Artificial intelligence in process control, 15:48110 (RA;US)
Computation of emissions from exhaust-gas composition measurements, 15:48148 (R;US)
Particle emissions, 15:49549 (R;FI)
Particle formation in combustion, 15:49552 (RA;FI)
Spectroscopy and structures of reactive intermediates, 15:49155 (RA;US)
COMBUSTORS
See also FLUIDIZED-BED COMBUSTORS
Effects of jet port arrangement on three-dimensional nonreacting jet -gas mixing in an MHD second stage combustor, 15:48106 (R;US)
Mechanisms of surface enrichment and adhesion of coal combustion particulates: Eighth and ninth quarterly reports, June 16, 1988–December 15, 1988, 15:48113 (R;US)
Mechanisms of surface enrichment and adhesion of coal combustion particulates: Sixth and seventh quarterly reports, December 16, 1987–June 15, 1988, 15:48112 (R;US)
The TRW entrained combustor retrofit at Orange and Rockland Utilities, Lovett Station Unit 3, 15:48486 (R;US)
Three-dimensional computer simulation of non-reacting jet-gas flow mixing in an MHD second stage combustor, 15:48107 (R;US)
COMETS
A unified model for the 3.28 μ m and 3.4 μ m spectral feature in the interstellar medium and in comets, 15:49757 (RA;FR)
Analogies between cometary, interplanetary and interstellar matter, 15:49753 (RA;FR)
Infrared cometary spectroscopy, 15:49752 (RA;FR)
Interpretation of the 10 μ m and 20 μ m absorption bands in comets, the ism and in an external galaxy, 15:49758 (RA;FR)
The unidentified IR bands in laboratory, in interstellar medium and in comets, 15:49754 (RA;FR)
COMMERCE (NUCLEAR)
See NUCLEAR TRADE
COMMERCIAL BUILDINGS
Commercial sector gas cooling technology frontier and market share analysis, 15:48771 (R;US)
Comparison of ELCAP data with lighting and equipment load levels and profiles assumed in regional models, 15:48794 (R;US)
State-of-the-art interior-piping-systems applications: Commercial buildings. Final report, June 1987-June 1989, 15:48792 (R;US)
COMMUNICATIONS
See also DATA TRANSMISSION
International english, 15:50254 (R;US)
COMMUNITIES (ECOLOGICAL)
See ECOSYSTEMS
COMPACT TORUS
Quasiequilibrium evolution of compact torus with toroidal field, 15:50176 (R;SU;In Russian)
COMPLEX TERRAIN
Atmospheric processes over complex terrain: Volume 23, No. 45, 15:49458 (R;US)
COMPLEXING AGENTS
See CHELATING AGENTS
COMPOSITE MATERIALS
See also SUPERCONDUCTING COMPOSITES
Analysis of deformation characteristics of a heavily deformed Cu- 20%Nb composite, 15:48880 (R;US)
Characterization of short fatigue cracks at notches in SiC particulate aluminum composite, 15:48957 (R;US)
Dynamic mechanical analysis of polymeric materials, 15:48968 (RA;US)
KFA Neutron irradiation programme on materials for high heat load components of fusion devices, 15:50171 (RA;FR)
Potential for advanced thermoplastic composites in space systems, 15:49405 (R;US)
Theory and experimental technique for nondestructive evaluation of ceramic composites, 15:48967 (R;US)

[Mechanical behavior of ceramics and composites]: Foreign trip report, August 2, 1990–August 22, 1990, 15:48933 (R;US)

COMPOSITE MODELS
Extra weak bosons in a confining gauge theory with complementarity, 15:49938 (R;JP)

COMPOUNDS (ORGANIC)
See ORGANIC COMPOUNDS

COMPRESSED AIR ENERGY STORAGE
Technical assessment and economic study of compressed air energy storage in Japan, 15:48685 (R;JP;In Japanese)

COMPTON EFFECT
Classical treatment of the Compton collision in general relativity, 15:49923 (R;FR)

COMPTON SCATTERING
See COMPTON EFFECT

COMPUTED TOMOGRAPHY
See COMPUTERIZED TOMOGRAPHY

COMPUTER ARCHITECTURE
Software quality assurance handbook, 15:50222 (R;US)

COMPUTER CALCULATIONS
Safety problems related to the use of MOX assemblies in PWRS, 15:48543 (R;FR)

COMPUTER CODES
See also E CODES
G CODES
K CODES
L CODES
P CODES
S CODES
T CODES
V CODES
W CODES
Modeling of coupled heat-mass stress effects in geologic media, 15:48342 (BA;US)

COMPUTER LANGUAGES
See PROGRAMMING LANGUAGES

COMPUTER PROGRAMS
See COMPUTER CODES

COMPUTER-AIDED DESIGN
IGES efficiency evaluation, 15:50244 (R;US)

COMPUTER-AIDED MANUFACTURING
IGES efficiency evaluation, 15:50244 (R;US)

COMPUTERIZED CONTROL SYSTEMS
Robotic requirements for plutonium handling automation, 15:49176 (J;US)

COMPUTERIZED TOMOGRAPHY
See also EMISSION COMPUTED TOMOGRAPHY
Multiple-energy techniques in industrial computerized tomography, 15:49318 (R;US)
Quality assurance of computed tomography scanner beams in diagnostic radiology, 15:49680 (RA;GB)
Quality control in computed tomography X-ray scanners, 15:49682 (RA;GB)
Quality control in quantitative computed tomography, 15:49681 (RA;GB)

COMPUTERS
See also CRAY COMPUTERS
DEC COMPUTERS
IBM COMPUTERS
MICROPROCESSORS
SICADS: Site Independent Configurable Alarm Display System, 15:50240 (R;US)

CONCENTRATOR SOLAR CELLS
Generic quality assurance/quality control guide for photovoltaic concentrator design, development and system installation, 15:48460 (R;US)

CONCRETES
See also REINFORCED CONCRETE
Canadian developments in testing concrete aggregates for alkali-aggregate reactivity, 15:48955 (R;CA)
Case studies of Ontario Hydro's experience with standard tests for alkali-aggregate reactivity, 15:49188 (RA;CA)
Decontamination of concrete by superficial melting with a new burner associated to a plasma (feasibility study), 15:48279 (R;FR;In French)
Development of the Structural Materials Information Center, 15:48646 (R;US)
Effect of bacterial activity on North Sea concrete, 15:48971 (R;GB)
Iowa State Mining and Mineral Resources Research Institute: Semi-annual report, July 1, 1989–December 31, 1989, 15:49738 (R;US)

CONDENSERS (ELECTRIC)
See CAPACITORS

CONDENSERS (STEAM)
See STEAM CONDENSERS

CONNECTORS
Development of hermetic microminiature connectors, 15:49217 (R;US)

CONSERVATION (ENERGY)
See ENERGY CONSERVATION

CONSOLIDATED FUEL REPROCESSING PROGRAM
Development of remote disassembly technology for liquid-metal reactor (LMR) fuel, 15:48579 (R;US)

CONTACT RADIOTHERAPY
See RADIOTHERAPY

CONTAINERS
See also DEWARS
PRESSURE VESSELS
REACTOR VESSELS
TANKS
A gas-flow source term from a nuclear waste container in an unsaturated medium, 15:48380 (BA;US)
An innovative cask for transporting defense high-level waste, 15:49171 (BA;US)
Decontamination and decommissioning facility environmental assessment, Feed Materials Production Center, Fernald, Ohio, 15:48261 (R;US)
State of Nevada nuclear waste shipping cask design studies, 15:49173 (BA;US)
Stress analysis of HLW containers Preliminary ring test exercise Compas project, 15:48278 (R;FR)

CONTAINMENT BUILDINGS
An analysis of containment venting as a severe accident mitigation strategy for the BWR Mark II containment, 15:48670 (J;US)
Dispositions taken in France to limit gaseous releases from PWR power plants in abnormal operating conditions, 15:48540 (R;FR)
Effects of design details on the capacity of steel containment buildings, 15:48654 (R;US)

CONTAMINATION (SURFACE)
See SURFACE CONTAMINATION

CONTENT ANALYSIS
See CHEMICAL ANALYSIS

CONTRAST MEDIA
Investigation of the permeation of radiocontrast agent into the experimentally irritated stratum corneum, 15:49692 (R;DE;In German)

CONTROL (RADIOACTIVITY)
See RADIATION MONITORING

CONTROL ELEMENTS
See also SCRAM RODS
[High-temperature reactor materials for gas-cooled reactor]: Foreign trip report, August 24, 1990–September 1, 1990, 15:48578 (R;US)

CONTROL RODS
See CONTROL ELEMENTS

CONTROL SYSTEMS
See also COMPUTERIZED CONTROL SYSTEMS
ON-LINE CONTROL SYSTEMS
DEPOT: Database for electronics parts and other things, 15:49271 (J;US)
Development of the fuzzy control system for heat-pump air conditioners, 15:48791 (R;JP)
Inherent reactor power controller for a metal-fueled ALMR, 15:48617 (J;US)

CONVECTION
See also FORCED CONVECTION
A resistance wire technique applied to heat transfer measurements in high aspect ratio fluidized beds, 15:48115 (R;US)
Numerical models of 2-D and 3-D geophysical convection, 15:49740 (R;US)

CONVERTERS (ANALOG-DIGITAL)
See ANALOG-TO-DIGITAL CONVERTERS

CONVERTERS (IMAGE)
See IMAGE CONVERTERS

COOLANTS
Analysis of PWR auxiliary coolant: determination of chloride in borax/nitrite solution by known addition - known dilution potentiometry, 15:48545 (R;GB)
Determination of boron as boric acid by automatic potentiometric titration using Gran plots [in pressurized water reactor coolant], 15:48993 (R;GB)
Gas-phase chemical reactivity of CFC-114 [Chloro-fluorocarbons-114] and potential replacements: Part 1, CFC-114 reactivity with Fsub 2 and UFsub 6, 15:48216 (R;US)

COOLERS
See HEAT EXCHANGERS

COOLING PONDS
International cooling-tower and spray pond symposium: Proceedings, 15:48601 (R;US)
Use of drainage wicks for an embankment on slickensided clay, 15:48498 (RA;CA)

COOLING SYSTEM (REACTOR)
See REACTOR COOLING SYSTEMS

COOLING SYSTEMS
See also REACTOR COOLING SYSTEMS
Commercial sector gas cooling technology frontier and market share analysis, 15:48771 (R;US)

COOLING TOWERS
International cooling-tower and spray pond symposium: Proceedings, 15:48601 (R;US)

COPPER
Adsorption and surface reactions of H_2S and SO_2 on Cu(100) studied by electron-energy-loss spectroscopy, 15:49134 (RA;US)
Analysis of deformation characteristics of a heavily deformed Cu- 20%Nb composite, 15:48880 (R;US)
Application of ion beam sputtering for diffusion study in solids, 15:50065 (R;GB)
Calculation of energy release depth distributions for electrons with 5-100 MeV energy in thick targets, 15:50057 (RA;SU;In Russian)
Catalysis of carbon gasification: Influence of different modes of addition of catalysts. Annual report, January 1989-January 1990, 15:48081 (R;US)
Implementation and assessment of the mechanical-threshold-stress model using the EPIC2 and PINON computer codes, 15:48886 (R;US)
Laser Raman spectroscopy "for in-situ" analysis of corrosion films on metals, 15:48866 (R;US)
Stress versus temperature dependent activation energies in creep, 15:48852 (R;US)
Wear-metal analysis in engine oil by microwave digestion and atomic absorption spectroscopy. Final report, August 1987-January 1988, 15:48988 (R;US)
Work in progress, 15:49038 (RA;US)
Work in progress, 15:49100 (RA;US)

COPPER 64 TARGET
Investigation of anomalous pion production in the reaction Cu(p,π^+)X by 350 MeV protons, 15:50010 (RA;SU)

COPPER ALLOYS
Corrosion and arc erosion in MHD channels: Quarterly progress report, January–March 1990, 15:48757 (R;US)

COPPER OXIDES
Development of high-Tc superconducting wire with high critical current density, 15:48935 (R;JP)
Excess oxygen defects in layered cuprates, 15:48913 (R;US)
Fabrication of composite high temperature superconductor wires from Ag/$YBa_2Cu_3O_x$ power produced by $AgNO_3$ decomposition, 15:48901 (R;US)
Granular and superconducting-glass properties of the high-temperature superconductors, 15:48920 (R;US)
In-situ transmission electron microscopy and computer simulation study of the kinetics of oxygen loss in $YBa_2Cu_3O_z$, 15:48932 (R;US)
International workshop on ion beam modification and processing of high-Tc superconductors: Physics and devices: Program and abstracts, 15:48905 (R;GB)
Magnetic properties of Hubbard-sigma model with three-dimensionality, 15:48917 (R;JP)
Microfilamentary $Bi_2Sr_2Ca_1Cu_2O_8$ fibers, 15:48922 (R;US)
Nonlinear pressure dependence of T_c in single-crystal superconducting BiCaSrCuO, 15:48927 (RA;US)
Preparation and structural characterization of Tl-Sr-Ca-Cu-O superconducting materials, 15:48934 (R;JP)
Processing of $YBA_2Cu_3O_7$ tapes from a molten salt precursor, 15:48924 (R;US)
The upper critical field of $HoBa_2Cu_3O_{7-\delta}$ for H || c, 15:48918 (R;US)
Thermodynamic critical field of $Y_1Ba_2Cu_3O_7$, 15:48921 (R;US)
Work in progress, 15:48928 (RA;US)
$YBa_2Cu_3O_x$ composites with improved toughness and strength, 15:48916 (R;US)

CORES (REACTOR)
See REACTOR CORES

CORIUM
CORQUENCH: A model for gas sparging-enhanced melt-water, film boiling heat transfer, 15:48644 (R;US)
The MELTSPREAD-1 computer code for the analysis of transient spreading in containments, 15:48643 (R;US)

CORN (MAIZE)
See MAIZE

CORN STOVER
See AGRICULTURAL WASTES
MAIZE

CORONA (SOLAR)
See SOLAR CORONA

CORROSION INHIBITORS
Laser Raman spectroscopy "for in-situ" analysis of corrosion films on metals, 15:48866 (R;US)

COSMIC DUST
An almost total disjunction between emission and absorption dust features - what does it tell us, 15:49766 (RA;FR)
Infrared spectroscopy of dust, 15:49759 (RA;FR)
Interstellar extinction in the infrared, 15:49760 (RA;FR)
Spectropolarimetry as a diagnostic of the interstellar medium, 15:49761 (RA;FR)

COSMIC GAMMA BURSTS
Distance limits for gamma-ray bursts from galactic neutron stars, 15:49843 (BA;US)

COSMIC GASES
Photodissociation regions: observations and theory, 15:49763 (RA;FR)
Statistical characteristics of turbulence in giant molecular clouds. Part 1: 1. Spectra in inertial range, 15:49814 (R;UA)
Statistical characteristics of turbulence in giant molecular clouds. Part 2: 2. Clump properties, 15:49815 (R;UA)
The excitation of molecular hydrogen and its significance, 15:49775 (RA;FR)

COSMIC PARTICLES
See COSMIC RADIATION

COSMIC RADIATION
Cosmic ray production in plasma z pinches, 15:49809 (R;SU;In Russian)
Improved model for solar cosmic ray exposure in manned Earth orbital flights, 15:49716 (R;US)

COSMIC X-RAY BURSTS
The 1973 x-ray outburst of 4U1145-61, 15:49842 (BA;US)

COSMIC X-RAY SOURCES
See also COSMIC X-RAY BURSTS

Ground-based observations of celestial x-ray sources, 15:49832 (RA;ZA)

COSMOGONY
See COSMOLOGY

COSMOLOGICAL MODELS
On the thermodynamics of one-fluid Szekeres'like cosmologies, 15:49746 (R;BR)

COSMOLOGY
Classical theory of radiating strings, 15:49823 (R;GB)
Cosmological baryon and lepton number in the presence of electroweak fermion-number violation, 15:49820 (R;US)
Evolution of light domain walls interacting with dark matter, part 1, 15:49821 (R;US)
The microwave background in steady-state cosmology, 15:49800 (RA;FR)
Thermal relics: Do we know their abundances, 15:49822 (R;US)

COSMOS
See UNIVERSE

COSTA RICA
The text of the Agreement of 12 July 1973 between Costa Rica and the Agency for the application of safeguards in connection with the Treaty for the Prohibition of Nuclear Weapons in Latin America and the Treaty on the Non-Proliferation of Nuclear Weapons, 15:48389 (R;XA)

COUNTERFLOW COOLING TOWERS
See COOLING TOWERS

COUNTERS (RADIATION)
See RADIATION DETECTORS

COUNTY BUILDINGS
See PUBLIC BUILDINGS

COUPLINGS (MACHINE PARTS)
See MACHINE PARTS

COURT BUILDINGS
See PUBLIC BUILDINGS

CRACK GROWTH
See CRACK PROPAGATION

CRACK PROPAGATION
Crack-arrest behavior in SEN wide plates of low-upper-shelf base metal tested under nonisothermal conditions: WP-2 series, 15:48608 (R;US)

CRACKING
Selective steam cracking for energy and raw materials savings: Final report, 15:48137 (R;LU)

CRACKS
Fatigue crack characterization by ultrasonic inspection, 15:49189 (R;US)

CRAY COMPUTERS
What do you do when the network is 1 to 2 orders of magnitude faster than the backplane bus?, 15:50243 (R;US)

CREEP
Stress versus temperature dependent activation energies in creep, 15:48852 (R;US)

CREOSOTE
Best demonstrated available technology (BDAT) background document for waste-water treatment sludges generated in the production of creosote K035. Final report, 15:49510 (R;US)
Final best demonstrated available technology (BDAT) background document for K001 (addendum) and U051 (creosote). Volume 3, 15:49477 (R;US)
Final response to BDAT related comments document. K017/K028-K029, K095-096, K022, K025, K035, K026, K083, K024. Volume 1-M, 15:49527 (R;US)

CRESOLS
Anaerobic fluid-bed treatment of coal conversion wastewater: Tenth quarterly technical progress report, November 15, 1988–February 15, 1988, 15:48093 (R;US)

CRESYLIC ACID
See CRESOLS

CRITICAL HEAT FLUX
Present status of research on boiling critical heat flux at low flow velocity, 15:49183 (RA;JP;In Japanese)

CROPPING SYSTEMS
See CULTIVATION TECHNIQUES

CROPS
Methods to utilize tobacco kilns for curing (drying) and/or storage of alternate crops: Interim report. 1988 year, 15:48821 (R;CA)
Versatility of tobacco kilns eases shift to alternate crops, 15:48818 (R;CA)

CROSSFLOW COOLING TOWERS
See COOLING TOWERS

CRUDE CARRIERS
See TANKER SHIPS

CRUDE OIL
See PETROLEUM

CRYOGENIC BUBBLE CHAMBERS
Development of a cryogenic dark matter detector, 15:49344 (J;US)

CRYOGENICS
An investigation of thermally driven acoustical oscillations in helium systems, 15:49251 (R;US)
Design and testing of a high temperature superconducting current lead, 15:49205 (R;US)
Performances of four magnetic heat-pump cycles, 15:49161 (R;US)

CRYSTAL LATTICES
Stress accommodation in large-mismatch systems, 15:48979 (R;US)

CRYSTALLINE ROCKS
See IGNEOUS ROCKS

CRYSTALS
See also POLYCRYSTALS
Strategy and tactics in the search for new harmonic generating crystals, 15:49094 (BA;US)
[Cross sections for lepton pair production and for capture of the pair-produced electrons to bound states of the fully-stripped projectiles]: Foreign trip report, July 18, 1990–August 31, 1990, 15:49917 (R;US)

CULTIVATION TECHNIQUES
A study of the impact of no-till on tractor fuel cost vs crop returns, as affected by various no-till planter modifications, 15:48819 (R;CA)

CULTURAL RESOURCES
Texas Barrier Islands Region ecological characterization atlas: Socioeconomic and natural features narrative, 15:49569 (R;US)

CUMULATIVE EFFECT
See PARTICLE PRODUCTION

CUPRATES
Experimental studies of effect of high current pulse electron and carbon ion beams on high temperature Y-Ba-Cu-O, Bi-Ca-Sr-Cu-O superconductors, 15:50078 (R;SU;In Russian)
On the electronic structure of high temperature superconductors: Nonalloyed CuOsub 2 plane, 15:50077 (R;SU;In Russian)

CURIUM IODIDES
Revision and additions to the energy levels of neutral cerium, ^{244}CmI, 15:49021 (RA;US)

CYANIDES
Final best demonstrated available technology (BDAT) background document addendum for cyanide wastes. Volume 14, 15:49488 (R;US)
Final response to BDAT related comments document. K071 and K106: Mercury cell process wastes K086: Residues from ink production wastes containing cyanide. Volume 1-L, 15:49608 (R;US)
Final response to BDATt related comments document D003. Volume 1-D, 15:49519 (R;US)

CYCLIC ACCELERATORS
See also BEVALAC
SYNCHROTRONS
The transverse displacement in a circular accelerator disturbs the hexapolar non-linearities. Application to the dynamical aperture problem, 15:49232 (R;FR;In French)

CYCLOTRON RADIATION
Diagnosis of superthermal electrons using cyclotron radiation, 15:50121 (R;FR)

D

D* PLUS RESONANCES
See BARYONS

D* ZERO RESONANCES
See BARYONS

D*RESONANCES
See BARYONS

D-T REACTORS
Diagnostics of a thermonuclear plasma, based on the use of nuclear reactions, 15:50146 (RA;CS;In Russian)
Some problems of plasma diagnostics in an experimental thermonuclear reactor, 15:50145 (RA;CS;In Russian)

DAMS
Stress-strain behavior of the LG 4 dam, 15:48451 (RA;CA)
The application of flexible jet grout for a cutoff at John Hart Dam, 15:48452 (RA;CA)
Use of drainage wicks for an embankment on slickensided clay, 15:48498 (RA;CA)

DARK MATTER
See NONLUMINOUS MATTER

DATA ACQUISITION SYSTEMS
Data acquisition system in CAMAC standard for multiparameter experiments, 15:49305 (R;SU;In Russian)
Data taking system for the FANCY, 15:50253 (RA;JP)
KODAQ (Kakuken On-line Data Acquisition System) based on PC-9801 personal computer, 15:50218 (R;JP;In Japanese)
Trigger/front end electronics and data collection, 15:49262 (RA;JP;In Japanese)

DATA BASE MANAGEMENT
Data quality assurance controls through the WIPP in situ data acquisition, analysis and management system, 15:48368 (BA;US)
The practical challenges of converting end-use data into information, 15:48795 (R;US)

DATA COVARIANCES
Computation of standard deviations in eigenvalue calculations, 15:50052 (R;US)

DATA DISPLAY DEVICES
See DISPLAY DEVICES

DATA DISPLAY SYSTEMS
See DISPLAY DEVICES

DATA TRANSMISSION
Integrated optical modulators for analog signal transmission, 15:49380 (R;US)

DC TO AC INVERTERS
See INVERTERS

DEBRIS (NUCLEAR)
See FISSION PRODUCTS

DEBYE-SCHERRER METHOD
Sintering of spherical glass powder under a uniaxial stress, 15:48984 (J;US)

DEC COMPUTERS
A versatile, programmable control and data acquisition system for complex integrated circuits, 15:49332 (J;US)

DECALSO
See ION EXCHANGE MATERIALS

DECIMETER WAVE RADIATION (1-3 DM)
See RADIOWAVE RADIATION

DECIMETER WAVE RADIATION (3-10DM)
See RADIOWAVE RADIATION

DECONTAMINATION
Selection and development of an easy to process electrolyte for decontamination by electropolishing, 15:48277 (R;FR;In German)

DECONTAMINATION FACTOR
See DECONTAMINATION

DEER
The ecology of elk in an arid environment: An overview of the Hanford elk project, 15:49640 (R;US)

DEFENSE
See NATIONAL DEFENSE

DEFORESTATION
Current status of forest decline and its research activities in Europe, 15:48702 (R;JP;In Japanese)

DEFORMED NUCLEI
Hyperdeformed pear-shaped nuclei, 15:50015 (R;FR)
The multiphonon version of the quasiparticle-phonon nuclear model: application to the problem of existence of low-lying two-phonon states in deformed nuclei, 15:50039 (R;SU)

DEHYDROGENASES
See OXIDOREDUCTASES

DELAWARE
Health assessment for Kent County Landfill (Houston), Houston, Kent County, Delaware, Region 3. CERCLIS No. DED980705727. Preliminary report, 15:49535 (R;US)

DELAYED NEUTRONS
Fission-product chain yields and delayed neutrons: ANS 5.2 and ANS 5.8, 15:49994 (R;US)

DELETIONS (CHROMOSOMAL)
See CHROMOSOMAL ABERRATIONS

DELTA RESONANCES (BARYON)
See N*BARYONS

DELTA RESONANCES (MESON)
See MESONS

DENATURATION (PROTEIN)
See PROTEIN DENATURATION

DENITRIFICATION
Development of water purification technologies for intensive fish culture. 3.: Selection of marine denitrifying bacteria by their denitrification pattern, 15:49591 (R;JP;In Japanese)

DENSITY
Computational aspects of a noncubic equation of state for phase equilibrium calculations. Effect of density-dependent mixing rules, 15:49068 (RA;US)

DENSITY (ENERGY-LEVEL)
See ENERGY-LEVEL DENSITY

DEPLETION (ISOTOPIC)
See ISOTOPE SEPARATION

DEPOSITION
Modeled sulfur deposition trends since 1990 in North America, 15:49456 (R;US)
Structure of Au and Pt films on Pd(110): Deposition temperature and coverage dependent (1 times 2) and (1 times 3) reconstructions, 15:48878 (R;US)
Summary of the NAPAP state of science report on deposition monitoring in North America, 1979–1987, 15:49457 (R;US)

DESERTRON
See SUPERCONDUCTING SUPER COLLIDER

DESIGN BASIS ACCIDENTS
Applications of safety analysis codes at the Institute of Atomic Energy, Beijing, 15:48547 (RA;XA)

DESULFURIZATION
Flue gas desulfurization (FGD) chemistry and analytical methods handbook: Volume 1, Process chemistry - Sampling, measurement, laboratory and process performance guidelines (Revision 1): Final report, 15:48514 (R;US)
Investigations on the diffusion of inorganic pollutants in selected sediments from the Asse cap rock and in clay samples from the Niederwallach landfill, 15:49459 (RA;DE;In German)

DETECTION (NUCLEAR EXPLOSIONS)
See NUCLEAR EXPLOSION DETECTION

DETECTORS (RADIATION)
See RADIATION DETECTORS

DEUTERIUM
A sensitive multi-detector neutron counter used to monitor cold fusion experiments in an underground laboratory: Negative results and positive artifacts, 15:49357 (J;US)
An apparatus for studies of hydrogen isotope exchange over metals using laser-Raman spectroscopy, 15:48998 (R;US)
EE Microfabrication facility toxic gas system: A probabilistic risk assessment using human reliability analysis methods, 15:49731 (R;US)
Experimental investigation of muon-catalysed fusion in pure deuterium: current status and future possibilities, 15:50183 (RA;GB)

Kinetics of the excited mesic hydrogen in the mixture of hydrogen isotopes, 15:50191 (RA;GB)

DEUTERIUM OXIDES
See HEAVY WATER

DEUTERIUM TARGET
Study of the effects in three-nucleon systems due to the violation of nuclear forces charge independence, 15:49946 (R;UA)
Threshold anomaly in doublet nd-scattering, 15:50033 (R;UA)

DEUTERIUM-LITHIUM HIGH FLUX NEUTRON SOURCE FACILITY
See NEUTRON SOURCE FACILITIES

DEUTERON BEAMS
Monitoring system for relativistic particles and nuclei, 15:49260 (R;SU)

DEUTERON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET

DEUTERONS
Deuteron $A(Q^2)$ structure function and the neutron electric form factor, 15:49904 (R;FR)
Production of high energy nuclei ^4He,^3He,^3H,^2H in interaction 10.1 GeV/c protons with Be,Al,Cu,Ta, 15:50032 (R;SU)
Relativistic corrections to energy levels of weakly bound states of mesic molecules $dd\mu$ and $dt\mu$, 15:49877 (RA;SU;In Russian)

DEVICES
See EQUIPMENT

DEWAR FLASKS
See DEWARS

DEWARS
Operation of a 2-phase return dewar in a satellite refrigerator, 15:49252 (R;US)

DIAGNOSTIC TECHNIQUES
See also BIOMEDICAL RADIOGRAPHY
Nuclear medicine and quantitative imaging research (instrumentation and quantitative methods of evaluation): Progress report, January 15–September 1, 1990, 15:49687 (R;US)

DIAMOND DRILLING EQUIPMENT
See DRILLING EQUIPMENT

DIELECTRIC MATERIALS
Dielectric properties of fluxed barium titanate ceramics with zirconia additions, 15:48945 (J;US)
Elementary inversion, energy velocity, and a generalized Sommerfeld theorem, 15:50097 (R;US)

DIELECTRIC TRACK DETECTORS
Identification of cosmic heavy nuclei in an assembly of nuclear photoemulsions and dielectric track detectors, 15:49292 (R;SU;In Russian)

DIELECTRICS
See DIELECTRIC MATERIALS

DIESEL ENGINES
Determination of the levels of dinitropyrenes on diesel-exhaust particulate exhibiting excess mutagenic activity, 15:48123 (R;CA)
Influence of experimental pulmonary emphysema on toxicological effects from inhaled nitrogen dioxide and diesel exhaust. Research report, January 1984-September 1987, 15:49721 (R;US)
Injector and valve train friction studies: Cummins L-10 engine: Progress report, October 1, 1988–December 31, 1989, 15:48836 (R;US)
Materials for enhanced heavy fuel capability marine diesels, 15:48931 (RA;US)
The determination of the levels of dinitropyrenes on diesel exhaust particulate exhibiting excess mutagenic activity: Final report, 15:48841 (R;CA)

DIFFERENTIAL EQUATIONS
See also NEUTRON DIFFUSION EQUATION
Symbolic manipulation software and the study of differential equations, 15:50215 (R;US)

DIFFRACTION (NEUTRON)
See NEUTRON DIFFRACTION

DIFFRACTION DISSOCIATION
See DIFFRACTION MODELS

DIFFRACTION MODELS
About a possibility to study the diffraction dissociation on the vertex detector spectrometer, 15:49306 (R;SU;In Russian)

DIFFRACTION PRODUCTION
See DIFFRACTION MODELS

DIGESTER GAS
See METHANE

DIODE TRANSISTORS
See TRANSISTORS

DIOXIN
Final response to BDAT related comments document. Leachates. Volume 1-P, 15:49529 (R;US)
Pilot study on international information exchange on dioxins and related compounds. Final report, 1985-1989, 15:49723 (R;BE)

DIPHENYLPHOSPHINE OXIDE
See ORGANIC PHOSPHORUS COMPOUNDS

DIRAC MATRICES
See DIRAC OPERATORS

DIRAC MONOPOLES
See MAGNETIC MONOPOLES

DIRAC OPERATORS
On zero modes of the Dirac operator on noncompact two-dimensional surface in magnetic field, 15:49968 (R;UA;In Russian)

DISARMAMENT
See ARMS CONTROL

DISCHARGES (WASTES)
See WASTE DISPOSAL

DISMANTLING (REACTOR)
See REACTOR DISMANTLING

DISPERSANTS (CHEMICAL)
See SURFACTANTS

DISPERSION NUCLEAR FUELS
Mechanistic interpretation of an observed rate dependence of low temperature swelling of irradiated uranium silicide dispersion fuels, 15:48217 (R;US)

DISPLACEMENT RATES
Work in progress, 15:49461 (RA;US)

DISPLAY DEVICES
See also INTERACTIVE DISPLAY DEVICES
Design and prototyping of the front end readout system for the CDF silicon vertex detector, 15:49273 (J;US)

DISPOSAL (WASTES)
See WASTE DISPOSAL

DISSOLVED GASES
Bias in peak clad temperature predictions due to uncertainties in modeling of ECC bypass and dissolved non-condensable gas phenomena, 15:48664 (R;US)

DISSOLVED OXYGEN
See DISSOLVED GASES
OXYGEN

DISTILLATION EQUIPMENT
Modelization and PC-based control of a distillation column - heat pump system, 15:48811 (R;FR;In French)

DISTRIBUTED DATA PROCESSING
The scalable coherent interface, IEEE P1596: Status and possible applications to data acquisition and physics, 15:49334 (J;US)

DISTRIBUTION
An information system for 20 kV electricity distribution networks integrated to telecontrol and automation, 15:50236 (R;FI;In Finnish)
Development of an energy management system, 15:48831 (R;FI;In Finnish)

DISTRICT HEATING
Development of an energy management system, 15:48831 (R;FI;In Finnish)
Vester Nebel combined collective heat supply system: Demonstration project: Final report, 15:48828 (R;LU)

DIVERTORS
KFA Neutron irradiation programme on materials for high heat load components of fusion devices, 15:50171 (RA;FR)

DNA REPAIR
[DNA repair and mutagenesis]: Foreign trip report, July 23, 1990–August 25, 1990, 15:49645 (R;US)

DNA SEQUENCING
Development of a small gantry robotic workcell for deoxyribonucleic acid (DNA) filter array construction, 15:49644 (R;US)
Stable isotope labels for DNA sequencing and mapping, 15:49647 (BA;US)
X-ray holography for sequencing DNA, 15:49652 (R;US)
DOCUMENTATION
List of publications 1989, 15:50208 (R;CS;In Czech, English)
DOEL-4 REACTOR
DOEL 4 - loss of external load transient: Simulation and analysis, 15:48556 (RA;XA)
DOGS
Application of high-frequency ventilation to treatment of chemical-warfare casualties: Animal and theoretical studies (application of high-frequency transtracheal jet ventilation to treatment of chemical-warfare casualties). Final report, March 1983-December 1986, 15:49410 (R;US)
Application of high-frequency ventilation to treatment of chemical-warfare casualties: Animal and theoretical studies. Annual report, 1 March 1984-28 February 1985, 15:49411 (R;US)
DOMAIN STRUCTURE
Chiral interface at the finite temperature transition point of QCD, 15:50048 (R;US)
Evolution of light domain walls interacting with dark matter, part 1, 15:49821 (R;US)
DOMESTIC WASTES
See MUNICIPAL WASTES
DORMITORIES
See RESIDENTIAL BUILDINGS
DOSE REDUCTION FACTOR
See RADIOPROTECTIVE SUBSTANCES
DOSE RELATIVE FACTOR
See RADIOPROTECTIVE SUBSTANCES
DOUBLE BETA DECAY
Double beta decay, neutrino physics, nuclear structure and isospin and spin-isospin symmetries, 15:49926 (R;BR)
DPA
See DISPLACEMENT RATES
DPO
See ORGANIC PHOSPHORUS COMPOUNDS
DRAINAGE
Predicted drainage at a semiarid site: Sensitivity to hydraulic property description and vapor flow, 15:48287 (R;US)
Red Canyon wash infiltration studies, 15:49592 (R;US)
DRAINAGE AREAS
See DRAINAGE
DRAINAGE SYSTEMS
See DRAINAGE
DREDGE SPOIL
General design memorandum, Gulfport Harbor, Mississippi. Design Memorandum Number 1. Appendix E. Thin-layer disposal. Final report, 15:49587 (R;US)
DRESDEN-2 REACTOR
Hydrogen water chemistry fuel surveillance at Dresden-2, 15:48530 (R;US)
DRF
See RADIOPROTECTIVE SUBSTANCES
DRIFT CHAMBERS
Development of second level trigger system based on a microprocessor array in the TRISTAN VENUS experiment, 15:49314 (RA;JP)
Fast-cycling minidrift chamber with freon-14 (80%) and isobutan (20%) mixture, 15:49299 (R;SU;In Russian)
High pressure gas scintillation drift chambers with wave-shifter fiber readout, 15:49345 (J;US)
Minidrift chambers. Operation with different gas mixtures, 15:49296 (R;SU;In Russian)
Upgrade of the AMY trigger system, 15:49315 (RA;JP)
DRILL HOLES
See BOREHOLES
DRILL SHIPS
See OFFSHORE PLATFORMS
DRILLING EQUIPMENT
Recent field trials of directional boring equipment for emplacing a borehole grid around and beneath a simulated waste site, 15:49742 (R;US)
DRILLING PLATFORMS
See OFFSHORE PLATFORMS
DROPLETS
Summary of the NAPAP state of science report on deposition monitoring in North America, 1979–1987, 15:49457 (R;US)
DRY DEPOSITION
See DEPOSITION
DRY-TYPE COOLING TOWERS
See COOLING TOWERS
DTO
See HEAVY WATER
DUAL-PURPOSE POWER PLANTS
Low-cost cogeneration system controller development. Final report, May 1988-July 1989, 15:48823 (R;US)
DUSTS
See also COSMIC DUST
Fabric filters: Filtermedia, 15:49553 (RA;FI)
Recycling of electric-arc-furnace dust, 15:48824 (R;US)
Results of the radiological survey at the Granite City Steel faciltiy, Granite City, Illinois, 15:49575 (R;US)
The theory and technics of particle measuring methods: Controlling measurements. Dust, 15:49556 (RA;FI)
DYE LASERS
High-pulse-energy flashlamp pumpable laser dyes. Interim technical report, 1 October 1989-31 March 1990, 15:49204 (R;US)
Ultranarrow-bandwidth vacuum ultraviolet (VUV)-XUV laser system, 15:49140 (RA;US)
DYES
Chemistry of anomalous-dispersion phase-matched second harmonic generation, 15:49084 (BA;US)
High-pulse-energy flashlamp pumpable laser dyes. Interim technical report, 1 October 1989-31 March 1990, 15:49204 (R;US)
DYMAC SYSTEM
See NUCLEAR MATERIALS MANAGEMENT
PLUTONIUM
DYNAMIC MATERIALS ACCOUNTABILITY SYSTEM
See NUCLEAR MATERIALS MANAGEMENT
PLUTONIUM
DYSPROSIUM 152
Population of superdeformed bands, the competition with fission, and the barrier between normal and superdeformed states, 15:50011 (R;US)
DYSPROSIUM COMPLEXES
On the stability and bonding in bis(η_7-arene)lanthanide complexes, 15:49063 (RA;US)
DYSPROSIUM OXIDES
Excess oxygen defects in layered cuprates, 15:48913 (R;US)

E

E CODES
Software for the ODRA and ODRENOK computers; programs for text file processing, 15:50220 (R;SU;In Russian)
EARTH ATMOSPHERE
See also EARTH MAGNETOSPHERE
IONOSPHERE
THERMOSPHERE
Deposition of airborne particles from fractured spent fuel or high-level waste, 15:48374 (BA;US)
Discussion paper on environmental hazards on the Moon, in low Earth orbit, and in low Mars orbit, 15:49817 (R;US)
Survey for impacts of global environmental issues on utilizations of alternative energies for oil, 15:49469 (R;JP;In Japanese)
EARTH MAGNETOSPHERE
See also MAGNETOTAIL
PLASMASPHERE
Development of a comprehensive magnetohydrodynamic model of solar-terrestrial interaction. Final report, 1 March 1986-30 September 1988, 15:49854 (R;US)

Viking data analysis. Final technical report, August 1986-March 1990, 15:49853 (R;US)

EARTH PLANET
Geometrical and dynamical characteristics of the Earth, the Moon and Terrestrial planets. Part 1: 1.Topographic surfaces and Gravitational fields, 15:49812 (R;UA;In Russian)

EBIC
See SCANNING ELECTRON MICROSCOPY

EBR-2 REACTOR
Command validation of secondary EM [electro-magnetic] pump system in the EBR-II [Experimental Breeder Reactor-II], 15:48611 (R;US)
Sensor validation for power plants using adaptive backpropagation neural network, 15:48616 (J;US)

ECCS
Bias in peak clad temperature predictions due to uncertainties in modeling of ECC bypass and dissolved non-condensable gas phenomena, 15:48664 (R;US)

ECOLOGICAL COMMUNITIES
See ECOSYSTEMS

ECOLOGICAL SUCCESSION
The use of cover crops for the maintenance of rights-of-way vegetation: A survey of the literature on succession, cover crops competition and trees, 15:48677 (R;CA)

ECOLOGY
[International meeting of ecology]: Foreign trip report, August 20, 1990–August 30, 1990, 15:49574 (R;US)
[Modeling of ecosystems]: Foreign trip report, August 21, 1990–September 4, 1990, 15:49412 (R;US)

ECOSYSTEMS
See also AQUATIC ECOSYSTEMS
[Modeling of ecosystems]: Foreign trip report, August 21, 1990–September 4, 1990, 15:49412 (R;US)

ECR HEATING
Diagnosis of superthermal electrons using cyclotron radiation, 15:50121 (R;FR)

EDDINGTON THEORY
General relativistic hydrodynamics and radiation transport, 15:50106 (BA;US)
Self-sustained mechanism of mass transfer and evolution of very low mass x-ray binaries, 15:49841 (BA;US)

EDTA
Strategies for utilizing ferrous*EDTA chelate as an additive in combined SO_2/NO_x aqueous scrubbing systems, 15:48499 (R;US)

EDUCATION
US Nuclear Engineering Education: Status and prospects, 15:48835 (R;US)

EFFLUENTS (LIQUID)
See LIQUID WASTES

EFFLUENTS (RADIOACTIVE)
See RADIOACTIVE EFFLUENTS

EIGENVALUES
Solution of eigenvalue problem for one class of hypersingular quasipotential integral equations, 15:50101 (R;SU;In Russian)

EINSTEIN GRAVITATION THEORY
See GENERAL RELATIVITY THEORY

EINSTEIN-DE SITTER MODEL
See COSMOLOGICAL MODELS

EKU
See EREVAN SYNCHROTRON

ELASTIC SCATTERING
See also COMPTON EFFECT
Neutron scattering in solid state physics and materials science, 15:48625 (RA;FR)

ELECTRIC BATTERIES
See also LEAD-ACID BATTERIES
METAL-NONMETAL BATTERIES
Shipping, use, and disposal/recycle considerations for sodium/beta batteries in electric vehicle (EV) applications, 15:48838 (R;US)

ELECTRIC CONDENSERS
See CAPACITORS

ELECTRIC FIELDS
Electric and magnetic fields and your health: A report of the Working Group on Electric and Magnetic ELP Fields, 15:49727 (R;CA)
The role of elf field dosimetry and bioeffects mechanisms in relating in vitro to in vivo exposures, 15:49730 (R;US)

ELECTRIC MOTORS
Japanese power electronics inverter technology and its impact on the American air conditioning industry, 15:48793 (R;US)

ELECTRIC POTENTIAL
An automated linearity test for direct voltage calibrators, 15:49386 (R;US)

ELECTRIC POWER
See also HYDROELECTRIC POWER
An information system for 20 kV electricity distribution networks integrated to telecontrol and automation, 15:50236 (R;FI;In Finnish)
Development of an energy management system, 15:48831 (R;FI;In Finnish)
Electricity: Getting more with less, 15:48802 (J;US)
Utilization of resources of the wood pulping industry - a holistic view, 15:48826 (RA;FI)

ELECTRIC POWER INDUSTRY
Guide for the application and use of valves in power plant systems: Final report, 15:48602 (R;US)
Manitoba Hydro application for an order requesting a general rate review and approval of certain rate adjustments effective April 1, 1990, 15:48753 (R;CA)
Survey of utility real-time pricing programs in the U.S, 15:48683 (R;JP;In Japanese)

ELECTRIC UTILITIES
Alberta electric industry annual statistics 1987, 15:48754 (R;CA)
Cogeneration and independent power production: Market insight and outlook: Final report, 15:48750 (R;US)
Commercial sector gas cooling technology frontier and market share analysis, 15:48771 (R;US)
DSM [Demand-Side-Management]: Transmission and distribution impacts: Volume 2, Application on spatial frequency analysis: Final report, 15:48749 (R;US)
Electric utility benefits of superconducting magnetic energy storage, 15:48497 (R;US)
Geothermal ground-loop preinstallation project at Walden Pond: Final report, 15:48780 (R;US)
Least-cost planning for Pacific Gas and Electric: Stage 1: Load Management Strategy Testing Model (LMSTM) calibration, 15:48751 (R;US)
Physical vulnerability of electric systems to natural disasters and sabotage, 15:48517 (R;US)
Program experience and its regulatory implications: A case study of utility lighting efficiency programs, 15:48784 (R;US)

ELECTRIC-POWERED VEHICLES
A microprocessor based charge control system for the simultaneous charging of several batteries with one charge controller: Final report for 1989, 15:48839 (R;US)
Shipping, use, and disposal/recycle considerations for sodium/beta batteries in electric vehicle (EV) applications, 15:48838 (R;US)

ELECTRICITE DE FRANCE
DER 89: main facts, 15:48736 (R;FR;In French)

ELECTROCATALYSTS
Electrocatalyst surfaces. Final report, December 1986-November 1989, 15:48762 (R;US)
Simultaneous particulates NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 2, October 1, 1987–December 31, 1987, 15:48504 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 3, January 1, 1988–March 31, 1988, 15:48505 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 4, April 1, 1988–June 30, 1988, 15:48506 (R;US)

Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 1, July 15, 1987–October 1, 1987, 15:48503 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 6, October 1, 1988–December 31, 1988, 15:48508 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 5, July 1, 1988–September 30, 1988, 15:48507 (R;US)
Work in progress, 15:49105 (RA;US)

ELECTROCHEMICAL CELLS
See also ELECTRIC BATTERIES
FUEL CELLS
Analysis and simulation of electrochemical systems, 15:49115 (RA;US)
High performance electrochemical generators, 15:48764 (R;FR;In French)
In situ laser Raman spectroscopy of copper anodization in alkaline media, 15:48694 (RA;US)
In situ scanning tunneling microscopy of Pb multilayer deposits on Ag, 15:48695 (RA;US)
Structural changes of oxide films during anodization of p-doped silicon in aqueous ammonium fluoride, 15:48696 (RA;US)
Surface layers on battery materials, 15:48693 (RA;US)
Work in progress, 15:49103 (RA;US)

ELECTROCHEMISTRY
Engineering analysis of electrolytic gas evolution, 15:49101 (RA;US)
Work in progress, 15:50234 (RA;US)

ELECTRODEPOSITION
Application of video microscopy to in situ studies of electrodeposition, 15:48692 (RA;US)

ELECTRODES
See also ANODES
CATHODES
Chemical stability of sodium beta″-alumina electrolyte in sulfur/sodium polysulfide melts, 15:49111 (RA;US)
Current distribution near an electrode edge as a primary distribution is approached, 15:49116 (RA;US)
Electrode kinetics and electrocatalysis, 15:48840 (RA;US)
Microscopic resolution of mass-transfer enhancement at vertical gas-evolving electrodes, 15:49102 (RA;US)
Simultaneous particulates NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 2, October 1, 1987–December 31, 1987, 15:48504 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemcial technology: Technical progress report No. 7, January 1, 1989–March 31, 1989, 15:48509 (R;US)
Surface-enhanced Raman spectroscopic (SERS) measurements in the liquid phase, 15:49027 (BA;US)
The effect of Schmidt number on the Faradaic impedance, 15:49120 (RA;US)
Work in progress, 15:49103 (RA;US)

ELECTROLYTE TILES
See MATRIX MATERIALS

ELECTROLYTES
See also SOLID ELECTROLYTES
Determination of the diffusion coefficient from impedance data in the low-frequency range, 15:49118 (RA;US)
Evaluation of room-temperature chloroaluminate molten salts as electrolytes for high energy density batteries. Final report, June 1988-April 1990, 15:48691 (R;US)
Explicit approximations to the mean spherical approximation (MSA) for electrolyte systems with unequal ion sizes, 15:50232 (RA;US)
Thermodynamics of electrolyte mixtures. Activity and osmotic coefficients consistent with the higher-order limiting law for symmetrical mixing, 15:49044 (RA;US)
Transference number calculations for sodium polysulfides, 15:49119 (RA;US)

ELECTROMAGNETIC FIELDS
Modified-Yee field solutions in the AMOS wakefield code, 15:49237 (R;US)
The role of elf field dosimetry and bioeffects mechanisms in relating in vitro to in vivo exposures, 15:49730 (R;US)
Vacuum polarization of electromagnetic field and electrodynamic processes on nucleus, 15:49897 (R;SU;In Russian)

ELECTROMAGNETIC RADIATION
See also RADIOWAVE RADIATION
X RADIATION
Forced scattering of a non-ordinary electromagnetic wave by an electron beam in a plasma in magnetic field, 15:50157 (R;UA;In Russian)
Integral equations for elastic wave scattering on nonuniformities in anisotropic media, 15:49235 (R;UA;In Russian)
Integrated optical modulators for analog signal transmission, 15:49380 (R;US)

ELECTROMAGNETIC WAVES
See ELECTROMAGNETIC RADIATION

ELECTRON ACCEPTOR
See ELECTRONS

ELECTRON BEAM INDUCED CURRENT
See SCANNING ELECTRON MICROSCOPY

ELECTRON BEAMS
Characteristics of the electron beam extracted onto the Deuteron-2 installation in the low background room of the Erevan synchrotron, 15:49248 (R;SU;In Russian)
Initial performance of the wire imaging synchrotron radiation detector, 15:49268 (J;US)
MONT3E: A Monte Carlo electron heat transfer code, 15:50088 (R;US)
Stochastic electron beams in the ion-focused regime, 15:49893 (R;US)

ELECTRON CHANNELING
Plane channeling and radiation of ultrarelativistic electrons in thick crystals, 15:50070 (R;SU;In Russian)

ELECTRON COLLISIONS
See also ELECTRON-ATOM COLLISIONS
ELECTRON-MOLECULE COLLISIONS
MONT3E: A Monte Carlo electron heat transfer code, 15:50088 (R;US)
The physics of electronic and atomic collisions, 15:49868 (B;US)

ELECTRON CYCLOTRON-RESONANCE HEATING
See ECR HEATING

ELECTRON DETECTION
Neural networks for triggering, 15:49269 (J;US)

ELECTRON DONOR
See ELECTRONS

ELECTRON EMISSION
Secondary-electron yield measurements from metals impacted by high- velocity ions, electrons, and molecules, 15:50084 (R;US)

ELECTRON SPECTROSCOPY
Sobre experimental aspects of electron correlation in molecules, 15:49865 (RA;BR)

ELECTRON TRANSFER
Dynamical solvent effects on electron-transfer processes: Recent progress and perspectives. Technical report, 15:49030 (R;US)
Intramolecular electron transfer rates: Three year progress report, 15:49124 (R;US)

ELECTRON-ATOM COLLISIONS
Updated excitation and ionization cross sections for electron impact on atomic oxygen. Quarterly report, 15:49891 (R;US)

ELECTRON-MOLECULE COLLISIONS
Dissociative recombination of molecular ions H_2^+, 15:49875 (R;SU;In Russian)

ELECTRON-POSITRON INTERACTIONS
Electroweak radiative corrections to deep inelastic scattering at HERA. Charged current scattering, 15:49949 (R;SU)
Measurement of α_s from energy-energy correlations in e^+e^- annihilation at 29 GeV, 15:49912 (R;US)
Measurement of the $e^+e^- \rightarrow b\bar{b}$ cross section and forward-backward charge asymmetry at a center-of-mass energy of 57.2 GeV, 15:49905 (R;US)

Probable method of $W^{\pm}$-boson mass and widths measurements, 15:49954 (RA;SU;In Russian)

ELECTRON-PROTON INTERACTIONS
Electroweak radiative corrections to deep inelastic scattering at HERA. Charged current scattering, 15:49949 (R;SU)
Excited quark production at ep and γp colliders, 15:49933 (R;SU)
Pion electroproduction near threshold on protons: how reaching the axial form factor of nucleon. Preparatory study of the experiment and pion spectrometer realization, 15:49906 (R;FR;In French)

ELECTRONIC CIRCUITS
See also GATING CIRCUITS
PRINTED CIRCUITS
DEPOT: Database for electronics parts and other things, 15:49271 (J;US)
Development of hermetic microminiature connectors, 15:49217 (R;US)
Experimental study of the single electron response of the DELPHI Barrel RICH MWPC's, 15:49287 (R;FR)
The electronics and data acquisition system for the wire imaging synchrotron radiation detector at the SLC, 15:49272 (J;US)
Thermal stresses in layered electrical assemblies bonded with solder, 15:49218 (R;US)

ELECTRONIC EQUIPMENT
See also ANALOG-TO-DIGITAL CONVERTERS
FUNCTION GENERATORS
MICROWAVE EQUIPMENT
Pulse-width dependent radiation effects on electronic components. Technical Note No. 89-33, 15:49399 (R;CA)

ELECTRONS
The electronics and data acquisition system for the wire imaging synchrotron radiation detector at the SLC, 15:49272 (J;US)

ELECTROPRODUCTION
Pion electroproduction near threshold on protons: how reaching the axial form factor of nucleon. Preparatory study of the experiment and pion spectrometer realization, 15:49906 (R;FR;In French)

ELECTROSTATIC ACCELERATORS
See also TANDEM ELECTROSTATIC ACCELERATORS
Study on beam injection systems of the EhGP-10M charge-exchange electrostatic accelerator, 15:49249 (R;SU;In Russian)

ELECTROSTATIC PRECIPITATORS
Electrostatic precipitators, 15:49555 (RA;FI)
Limb demonstration project extension: Quarterly report No. 12, February, March, and April, 1990, 15:48502 (R;US)
User-friendly data entry routine for the ESP model. Final report, June 1988-September 1989, 15:49545 (R;US)

ELECTROSTATIC WAVES
See PLASMA WAVES

ELEMENTARY PARTICLES
See also BEAUTY PARTICLES
CHARM PARTICLES
HADRONS
LEPTONS
BRST quantization of spinning relativistic particles with extended supersymmetries, 15:49959 (R;BR)
Research program in elementary particle theory: Task A: Progress report ending December 31, 1990, 15:49899 (R;US)
Thermal relics: Do we know their abundances, 15:49822 (R;US)

EMERGENCIES
See ACCIDENTS

EMERGENCY CORE COOLING SYSTEM
See ECCS

EMERGENCY RODS
See SCRAM RODS

EMISSION
See also ELECTRON EMISSION
Size distribution measurement of particles in flue gases, 15:49550 (RA;FI)
The theory and technics of particle measuring methods: Controlling measurements. Dust, 15:49556 (RA;FI)

EMISSION (ELECTRON)
See ELECTRON EMISSION

EMISSION COMPUTED TOMOGRAPHY
See also POSITRON COMPUTED TOMOGRAPHY
SINGLE PHOTON EMISSION COMPUTED TOMOGRAPHY
Nuclear medicine and quantitative imaging research (instrumentation and quantitative methods of evaluation): Progress report, January 15–September 1, 1990, 15:49687 (R;US)

EMISSION SPECTROSCOPY
See also FLUORESCENCE SPECTROSCOPY
Laser spectroscopy in a laser-produced plasma at atmospheric pressure: comparison between A.E.S., L.I.F., and L.E.I./R.I.S. for the analysis of solid samples, 15:48990 (R;FR)
Transient infrared emission spectroscopy, 15:48996 (R;US)

EMITTANCE (BEAM)
See BEAM EMITTANCE

ENERGY
See also GEOTHERMAL ENERGY
HEAT
POTENTIAL ENERGY
Report on the preparatory investigation of the Pacific energy information network system, 15:48741 (R;JP;In Japanese)

ENERGY AUDITS
Energy accounting manual, 15:48804 (R;CA)

ENERGY CONSERVATION
Affordable comfort III program, 15:48797 (B;US)

ENERGY CONSUMPTION
Development of an energy management system, 15:48831 (R;FI;In Finnish)
Energy use and the US economy. Background paper, 15:48700 (R;US)

ENERGY DEMAND
An integrated acid precipitation policy and energy market model, 15:48097 (R;US)

ENERGY LEVELS
See also EXCITED STATES
Relativistic correction of the energy atomic levels, 15:49864 (RA;BR;In Spanish)

ENERGY MODELS
Modelization of the energy demand. Application to the OECD countries, 15:48697 (R;FR;In French)

ENERGY SOURCE DEVELOPMENT
A handbook for management of oil and gas activities on lands in Alaska: Petroleum industry practices, environmental impacts and stipulations, 15:48149 (R;US)
Environmental Studies Research Funds annual report, 1989, 15:48747 (R;CA)
Gulf of Mexico Sales 131, 135, and 137: Central, western and eastern planning areas: Final environmental impact statement: Volume 1, Sections I through IV.C, 15:48705 (R;US)

ENERGY SOURCES
See also FOSSIL FUELS
NUCLEAR FUELS
RENEWABLE ENERGY SOURCES
WOOD FUELS
Short-term energy outlook: Quarterly projections, 15:48739 (R;US)
Short-term integrated forecasting system: 1990 model documentation report, 15:48740 (R;US)

ENERGY STORAGE SYSTEMS
Electrical and electrochemical behavior of particulate electrodes, 15:49107 (RA;US)
Electrode kinetics and electrocatalysis, 15:48840 (RA;US)
Engineering analysis of electrolytic gas evolution, 15:49101 (RA;US)
Fluid flow and mass transport in small cavities, 15:49108 (RA;US)
Surface morphology of metals in electrodeposition, 15:48684 (RA;US)

ENERGY SUPPLIES
International risk factors affecting Finnish energy supplies, 15:48742 (R;FI;In Finnish)

ENERGY-LEVEL DENSITY
Level density parameter of nuclei at finite temperature, 15:50008 (R;FR)

ENERGY-LEVEL SCHEMES
See ENERGY LEVELS
ENGINEERED SAFETY SYSTEMS
See also ECCS
EE Microfabrication facility toxic gas system: A probabilistic risk assessment using human reliability analysis methods, 15:49731 (R;US)
ENGINEERING GEOLOGY
Materials: From theory to practice: Proceedings, 15:49744 (R;CA)
ENGINEERS
Guide for the preparation of proposals for the pre-freshman enrichment program, PREP, 1991, 15:48834 (R;US)
ENHANCED RECOVERY
A coal fired steam generator demonstration for heavy oil recovery operations, 15:48194 (RA;CA)
How to make money producing heavy oil?, 15:48203 (RA;CA)
ENRICHMENT (ISOTOPIC)
See ISOTOPE SEPARATION
ENVIRONMENT
A more rugged ZnS(Ag) alpha scintillation detector, 15:49564 (J;US)
Advantages of a modular design approach for radiological instrumentation, 15:49561 (J;US)
Environmental program overview for a high-level radioactive waste repository at Yucca Mountain (Yucca Mountain Project), 15:48268 (R;US)
Hanford Environmental Dose Reconstruction Project: Monthly report, August 1990, 15:49546 (R;US)
New method permits the detection of alpha emitters at a distance, 15:49563 (J;US)
Proceedings [of the] Environmental research: Technology transfer conference: Volume 2. Liquid and solid waste, analytical methods, environmental socio-economics, 15:48733 (R;CA)
Robotic requirements for plutonium handling automation, 15:49176 (J;US)
The role of model based control in robotics, 15:50248 (J;US)
ENVIRONMENTAL EXPOSURE
Chemical data bases for the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1, 15:49151 (R;US)
Multimedia Environmental Pollutant Assessment System (MEPAS) application guidance: Volume 1, User's guide, 15:49548 (R;US)
Multimedia Environmental Pollutant Assessment System (MEPAS) application guidance: Volume 2, Guidelines for evaluating MEPAS input parameters, 15:49583 (R;US)
Supplemental mathematical formulations: The Multimedia Environmental Pollutant Assessment System (MEPAS), 15:49547 (R;US)
ENVIRONMENTAL EXPOSURE CHAMBERS
See EXPOSURE CHAMBERS
ENVIRONMENTAL EXPOSURE PATHWAY
Multimedia Environmental Pollutant Assessment System (MEPAS) application guidance: Volume 2, Guidelines for evaluating MEPAS input parameters, 15:49583 (R;US)
Supplemental mathematical formulations: The Multimedia Environmental Pollutant Assessment System (MEPAS), 15:49547 (R;US)
ENVIRONMENTAL PARKS
See NATURE RESERVES
ENVIRONMENTAL POLICY
An integrated acid precipitation policy and energy market model, 15:48097 (R;US)
Development, application and assessment of a taxonomy for characterizing international environmental problems. Master's thesis, 15:48735 (R;US)
Environmental impact assessment for a radioactive waste facility: A case study, 15:48259 (R;US)
Environmental program overview for a high-level radioactive waste repository at Yucca Mountain (Yucca Mountain Project), 15:48268 (R;US)
ENVIRONMENTAL TRANSPORT
See also RADIONUCLIDE MIGRATION
RUNOFF
Chemical data bases for the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1, 15:49151 (R;US)
Multimedia Environmental Pollutant Assessment System (MEPAS) application guidance: Volume 1, User's guide, 15:49548 (R;US)
Multimedia Environmental Pollutant Assessment System (MEPAS) application guidance: Volume 2, Guidelines for evaluating MEPAS input parameters, 15:49583 (R;US)
Supplemental mathematical formulations: The Multimedia Environmental Pollutant Assessment System (MEPAS), 15:49547 (R;US)
ENZYMES
See also HYDROLASES
OXIDOREDUCTASES
Computer simulation of chemical reactions in synthetic model compounds and genetically engineered active sites. Final report, 1 July 1989-30 June 1990, 15:49641 (R;US)
EPSILON RESONANCES
See MESONS
EQUATIONS (DIFFERENTIAL)
See DIFFERENTIAL EQUATIONS
EQUILIBRIUM PLASMA
Equilibrium distributions in plasma-molecular systems with non-plane boundaries, 15:50154 (R;UA;In Russian)
EQUIPMENT
See also DISTILLATION EQUIPMENT
DRILLING EQUIPMENT
ELECTRONIC EQUIPMENT
FARM EQUIPMENT
HEAT RECOVERY EQUIPMENT
OPTICAL EQUIPMENT
THERMAL ENERGY STORAGE EQUIPMENT
X-RAY EQUIPMENT
Decontamination and decommissioning facility environmental assessment, Feed Materials Production Center, Fernald, Ohio, 15:48261 (R;US)
EQUIPMENT INTERFACES
Interface for the local net B0612, 15:49208 (R;SU;In Russian)
ERBIUM 168
Description of low-lying vibrational $K^{\pi} \neq 0^{+}$ states of deformed nuclei in the quasiparticle-phonon nuclear model, 15:50041 (R;SU)
ERBIUM COMPLEXES
On the stability and bonding in bis(η-arene)lanthanide complexes, 15:49063 (RA;US)
EREVAN SYNCHROTRON
The estimate of the threshold energy of Yerevan synchrotron with a new accelerating system, 15:49244 (R;SU;In Russian)
ESCA
See ELECTRON SPECTROSCOPY
ESTERS
Extraction of fatty-acid methyl esters with supercritical carbon dioxide, 15:49070 (RA;US)
ESTUARIES
Willapa Bay: A historical perspective and a rationale for research, 15:49593 (R;US)
ESTUARINE ECOSYSTEMS
See AQUATIC ECOSYSTEMS
ETA MESONS
Decays of η- and K_L-mesons into a lepton pair: three-dimensional theory and phenomenology, 15:49951 (R;SU;In Russian)
On mixing of states in relativistic-invariant theory, 15:49937 (R;SU;In Russian)
ETA PRIME-958 MESONS
On mixing of states in relativistic-invariant theory, 15:49937 (R;SU;In Russian)
ETA-549
See ETA MESONS
ETA-700 RESONANCES
See MESONS
ETA-958 RESONANCES
See ETA PRIME-958 MESONS

ETHANE
Government of Alberta ethane policy implementation procedures: Information letter 90-9, 15:48186 (R;CA)
ETHANOL
Research on sweet sorghum (Sorghum Bicolor), 15:48431 (RA;LU)
ETHANOL PLANTS
Canadian experience with renewable fuels, 15:48439 (RA;CA)
ETHERS
Synthesis and crystal structure of a lariat ether complex: Sodium SYM-(dibenzo-14-crown-4) methyl phenyl phosphinate pentahydrate, 15:49087 (BA;US)
ETHNIC GROUPS
See MINORITY GROUPS
ETHOCEL
See CELLULOSE ETHERS
ETHYL ALCOHOL
See ETHANOL
ETHYLENE
Best demonstrated available technology (BDAT) background document for U and P wastes and multi-source leachate (F039). Volume E. Gaseous U and P wastes. Final report, 15:49514 (R;US)
Final response to BDAT related comments document. Volume 1-Q, 15:49530 (R;US)
Observation of correlation effects in zero kinetic energy electron spectra near the N1s and C1s thresholds in N_2, CO, C_6H_6, and C_2H_4, 15:49131 (RA;US)
Resonant processes above the carbon 1s ionization threshold in benzene and ethylene, 15:49133 (RA;US)
Selective steam cracking for energy and raw materials savings: Final report, 15:48137 (R;LU)
ETHYLENE POLYMERS
See POLYETHYLENES
ETHYLENEDIAMINETETRAACETIC ACID
See EDTA
EUROPE
See also WESTERN EUROPE
Current status of forest decline and its research activities in Europe, 15:48702 (R;JP;In Japanese)
EUROPEAN COMMUNITIES
Bio-energy-industrial integrated regional projects in the European community, 15:48409 (RA;LU)
Interchange of researchers on alternative energy of petroleum in EC countries, 15:48732 (R;JP;In Japanese)
The LEBEN project as an example of an integrated agro-energy approach, 15:48415 (RA;LU)
EUROPIUM COMPLEXES
On the stability and bonding in bis(η-arene)lanthanide complexes, 15:49063 (RA;US)
EUROPIUM IONS
Complexation of lanthanide(III) ions by catechol and similar ligands, 15:49059 (RA;US)
EXCHANGE (HEAT)
See HEAT TRANSFER
EXCITED STATES
See also RYDBERG STATES
The small-molecule limit of infrared multiphoton dissociation: Collisional effects in D_2CO, 15:49040 (RA;US)
EXHAUST GASES
Computation of emissions from exhaust-gas composition measurements, 15:48148 (R;US)
Determination of the levels of dinitropyrenes on diesel-exhaust particulate exhibiting excess mutagenic activity, 15:48123 (R;CA)
EE Microfabrication facility toxic gas system: A probabilistic risk assessment using human reliability analysis methods, 15:49731 (R;US)
I/m test variability. Technical report, 15:48160 (R;US)
Influence of experimental pulmonary emphysema on toxicological effects from inhaled nitrogen dioxide and diesel exhaust. Research report, January 1984-September 1987, 15:49721 (R;US)
EXHAUST SYSTEMS
Dispositions taken in France to limit gaseous releases from PWR power plants in abnormal operating conditions, 15:48540 (R;FR)
Materials for enhanced heavy fuel capability marine diesels, 15:48931 (RA;US)
EXPERIMENTAL BREEDER REACTOR-2
See EBR-2 REACTOR
EXPERIMENTAL FACILITIES (ACCELERATOR)
See ACCELERATOR FACILITIES
EXPLORATORY WELLS
Calculation of Monte Carlo importance functions for use in nuclear-well logging calculations, 15:49375 (J;US)
EXPOSURE CHAMBERS
Exposure system for animal studies involving high-level 60-Hz magnetic fields, 15:49729 (R;CA)

F

F-1540 RESONANCES
See MESONS
F1 LAYER
Neutral and ion composition changes in the F Region over Millstone Hill during the equinox transition study, 15:49856 (R;US)
F2 LAYER
Distribution of the daily $F0F_2$ about the monthly median, 15:49859 (R;US)
FABRIC FILTERS
Dry FGD [flue-gas desulfurization] at Argonne National Laboratory, 15:48500 (R;US)
FABRICATION
See also SINTERING
New trends in radiation processing application in Japan, 15:48406 (RA;JP)
FACILITIES (ACCELERATOR)
See ACCELERATOR FACILITIES
FACILITIES (MILITARY)
See MILITARY FACILITIES
FACILITIES (NUCLEAR)
See NUCLEAR FACILITIES
FACILITIES (RESOURCE RECOVERY)
See RESOURCE RECOVERY FACILITIES
FACILITIES (STORAGE)
See STORAGE FACILITIES
FACILITIES (TEST)
See TEST FACILITIES
FALLOUT PARTICULATES
See PARTICLES
FARADAY CAGES
See FARADAY CUPS
FARADAY CUPS
A very wide bandwidth Faraday cup suitable for measuring gigahertz structure on ion beams with velocities down to $\beta < 0.01$, 15:49241 (R;US)
FARM EQUIPMENT
A study of the impact of no-till on tractor fuel cost vs crop returns, as affected by various no-till planter modifications, 15:48819 (R;CA)
FAST BREEDER TYPE REACTORS
See FBR TYPE REACTORS
FAST-MIXED SPECTRUM REACTOR
See FBR TYPE REACTORS
FASTBUS SYSTEM
ARTEMIS: A VMS based FASTBUS module testing and evaluation system, 15:49281 (J;US)
The single-chip FASTBUS slave interface, 15:50245 (J;US)
FBR TYPE REACTORS
See also LMFBR TYPE REACTORS
MONJU REACTOR
Experimental research of local hydrodynamic characteristics of fast reactor fuel assembly peripheral zone. 5: Results of measurement at group displacement. SPOGVY variants, 15:48584 (R;CS;In Russian)

FEDERAL REGION I
See also MASSACHUSETTS
NEW HAMPSHIRE
RHODE ISLAND
Site Enforcement Tracking System (SETS) (Region 1) (for microcomputers). Data file, 15:48714 (R;US)
FEDERAL REGION III
See also DELAWARE
MARYLAND
PENNSYLVANIA
VIRGINIA
Site Enforcement Tracking System (SETS) (Region 3) (for microcomputers). Data file, 15:48716 (R;US)
FEDERAL REGION IV
See also ALABAMA
KENTUCKY
MISSISSIPPI
TENNESSEE
Site Enforcement Tracking System (SETS) (Region 4) (for microcomputers). Data file, 15:48717 (R;US)
FEDERAL REGION IX
See also CALIFORNIA
Site Enforcement Tracking System (SETs) (Region 9) (for microcomputers). Data file, 15:48722 (R;US)
FEDERAL REGION V
See also ILLINOIS
MINNESOTA
Site Enforcement Tracking System (SETS) (Region 5) (for microcomputers). Data file, 15:48718 (R;US)
FEDERAL REGION VI
See also NEW MEXICO
OKLAHOMA
TEXAS
Site Enforcement Tracking System (SETs) (Region 6) (for microcomputers). Data file, 15:48719 (R;US)
FEDERAL REGION VII
See also IOWA
Site Enforcement Tracking System (SETs) (Region 7) (for microcomputers). Data file, 15:48720 (R;US)
FEDERAL REGION VIII
See also COLORADO
Site Enforcement Tracking System (SETs) (Region 8) (for microcomputers). Data file, 15:48721 (R;US)
FEDERAL REGION X
See also WASHINGTON
Site Enforcement Tracking System (SETts) (Region 10) (for microcomputers). Data file, 15:48723 (R;US)
Willapa Bay: A historical perspective and a rationale for research, 15:49593 (R;US)
FEED MATERIALS PRODUCTION CENTER
Decontamination and decommissioning facility environmental assessment, Feed Materials Production Center, Fernald, Ohio, 15:48261 (R;US)
FEEDBACK
Oscillation onset in neural delayed feedback, 15:49704 (R;US)
FEEDWATER HEATERS
LQG/LTR control system design for a low-pressure feedwater heater train with time delay, 15:48612 (R;US)
FERMENTATION ALCOHOL
See ETHANOL
FERMILAB ACCELERATOR
Neural networks for triggering, 15:49269 (J;US)
Silcon microstrip electronics operating with 20 nsec FWHM signals, 15:49358 (J;US)
FERMILAB TEVATRON
An investigation of thermally driven acoustical oscillations in helium systems, 15:49251 (R;US)
Operation of a 2-phase return dewar in a satellite refrigerator, 15:49252 (R;US)
FERMIONS
See also BARYONS
LEPTONS
QUARKS
Relativistic massive particle with higher curvatures as a model for description of bosons and fermions, 15:49935 (R;SU)
Single-time reduction of bethe-salpeter formalism for two-fermion system, 15:49966 (R;SU)
FERRIC COMPOUNDS
See IRON COMPOUNDS
FERRITES
Assessment of modular IGCC plants based on entrained flow coal gasification supplemental studies, 15:48489 (R;US)
FERRITIC STEELS
See also STEEL-CR9MONBV
Materials selection issues for structural components of transportation casks, 15:48240 (BA;US)
The function of the HFR, Petten, in the development of plasma facing components for fusion reactors, 15:50172 (RA;FR)
FERROCENE
Ionic atmosphere effects on the energetics of thermal and optical electron-exchange reactions: Application to ferrocenium-ferrocene self exchange. Technical report, 15:49031 (R;US)
FERROUS COMPOUNDS
See IRON COMPOUNDS
FIBER OPTICS
Fiber-optical systems in physical experiment technique. Part 1: Part 1: Concepts and components, 15:49378 (R;SU;In Russian)
Optical data transmission at the superconducting super collider, 15:49368 (J;US)
FIELD EFFECT TRANSISTORS
Field-effect superconducting transistor, 15:49215 (R;JP)
FIELD OPERATORS
Seeley-Gilkey coefficients for the fourth-order operators on a Riemannian manifold, 15:49969 (R;UA)
FIELD THEORIES
See also GENERAL RELATIVITY THEORY
QUANTUM FIELD THEORY
UNIFIED-FIELD THEORIES
Symmetries of Chern-Simons theory in Landau gauge, 15:49958 (R;BR)
FIELDS (ELECTRIC)
See ELECTRIC FIELDS
FIELDS (ELECTROMAGNETIC)
See ELECTROMAGNETIC FIELDS
FIELDS (GRAVITATIONAL)
See GRAVITATIONAL FIELDS
FIELDS (MAGNETIC)
See MAGNETIC FIELDS
FILAMENT (PLASMA)
See PLASMA FILAMENT
FILAMENTS
Microfilamentary $Bi_2Sr_2Ca_1Cu_2O_8$ fibers, 15:48922 (R;US)
FILM BOILING
CORQUENCH: A model for gas sparging-enhanced melt-water, film boiling heat transfer, 15:48644 (R;US)
FILMS
See also SUPERCONDUCTING FILMS
THIN FILMS
In situ laser Raman spectroscopy of copper anodization in alkaline media, 15:48694 (RA;US)
Structural changes of oxide films during anodization of p-doped silicon in aqueous ammonium fluoride, 15:48696 (RA;US)
Work in progress, 15:49078 (RA;US)
FILTERS
See also FABRIC FILTERS
Development of a small gantry robotic workcell for deoxyribonucleic acid (DNA) filter array construction, 15:49644 (R;US)
Development of water purification technologies for intensive fish culture. 2.: Factors affecting nitrification in marine biological filter system, 15:49590 (R;JP;In Japanese)
Dispositions taken in France to limit gaseous releases from PWR power plants in abnormal operating conditions, 15:48540 (R;FR)
State-of-the-art interior-piping-systems application: On-site H_2S/O_2 removal technology. Final report, June 1988-March 1989, 15:48190 (R;US)

FINGERPRINTING (OIL SPILLS)
See OIL SPILLS
FINLAND
International risk factors affecting Finnish energy supplies, 15:48742 (R;FI;In Finnish)
FIRE STATIONS
See PUBLIC BUILDINGS
FIREDAMP
See METHANE
FIRES
Tracer gas used for the mine-fire simulations. Report No. CRL 89-87(TR), 15:48101 (R;CA)
FIREWOOD
See WOOD FUELS
FIRST WALL
Data compilation of angular distributions of sputtered atoms, 15:50087 (R;JP)
FISH CULTURE
See FISHERIES
FISH HATCHERIES
See FISHERIES
FISHERIES
Development of water purification technologies for intensive fish culture. 3.: Selection of marine denitrifying bacteria by their denitrification pattern, 15:49591 (R;JP;In Japanese)
FISHES
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): Striped bass, 15:49588 (R;US)
FISSION FRAGMENTS
High dynamic range discriminator for measurements with fragmented heavy ions, 15:49341 (J;US)
FISSION PRODUCT RELEASE
MITRA an advanced code to calculate radionuclide release from nuclear fuels under general irradiation conditions, 15:48619 (R;FR)
FISSION PRODUCTS
JENDL fission product nuclear data libraries: Contents and documentation, 15:49983 (R;XA)
FISSION YIELD
Fission-product chain yields and delayed neutrons: ANS 5.2 and ANS 5.8, 15:49994 (R;US)
FISSIONABLE MATERIALS MANAGEMENT
See NUCLEAR MATERIALS MANAGEMENT
FIXATION (CARBON DIOXIDE)
See CARBON DIOXIDE FIXATION
FLAME SPECTROMETRY
See EMISSION SPECTROSCOPY
FLOW (FLUID)
See FLUID FLOW
FLOW CYTOMETERS
See CELL FLOW SYSTEMS
FLUE GAS
Calculation of transport and radiation properties of flue gases, 15:49463 (R;FI;In Finnish)
Dry FGD [flue-gas desulfurization] at Argonne National Laboratory, 15:48500 (R;US)
Evaluation of a high-temperature burner-duct-recuperator system: A technical case study, 15:48806 (R;US)
Flue gas desulfurization (FGD) chemistry and analytical methods handbook: Volume 1, Process chemistry - Sampling, measurement, laboratory and process performance guidelines (Revision 1): Final report, 15:48514 (R;US)
Proof of concept testing of the advanced NOXSO flue gas cleanup process: Quarterly technical progress report, April 1–June 30, 1990, 15:48512 (R;US)
Simultaneous particulates NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 2, October 1, 1987–December 31, 1987, 15:48504 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 4, April 1, 1988–June 30, 1988, 15:48506 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemcial technology: Technical progress report No. 7, January 1, 1989–March 31, 1989, 15:48509 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 5, July 1, 1988–September 30, 1988, 15:48507 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 6, October 1, 1988–December 31, 1988, 15:48508 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 8, April 1, 1989–June 30, 1989, 15:48510 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 3, January 1, 1988–March 31, 1988, 15:48505 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 1, July 15, 1987–October 1, 1987, 15:48503 (R;US)
Simultaneous particulates, NOx_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 9, July 1, 1989–September 30, 1989, 15:48511 (R;US)
Size distribution measurement of particles in flue gases, 15:49550 (RA;FI)
FLUID FLOW
See also SOLIDS FLOW
TRANSITION FLOW
TURBULENT FLOW
VORTEX FLOW
A computer program system for the analysis of 3-d steady flows in turbomachinery components, 15:49178 (R;DE;In German)
Predicted drainage at a semiarid site: Sensitivity to hydraulic property description and vapor flow, 15:48287 (R;US)
Unsteady fluid forces and fluidelastic vibration of a group of circular cylinders, 15:49177 (R;US)
FLUID MECHANICS
Three-dimensional computer simulation of non-reacting jet-gas flow mixing in an MHD second stage combustor, 15:48107 (R;US)
Transport, mixing and stretching in a chaotic Stokes flow: The two-roll mill, 15:49898 (R;US)
FLUIDIZED BED
See FLUIDIZED BEDS
FLUIDIZED BED HEAT EXCHANGERS
A cold model study of wear on fluidized bed combustor tubes, 15:48890 (RA;US)
Work in progress, 15:48891 (RA;US)
FLUIDIZED BEDS
A resistance wire technique applied to heat transfer measurements in high aspect ratio fluidized beds, 15:48115 (R;US)
FLUIDIZED-BED COMBUSTORS
Behavior of tubing steels in FBC in-service testing, 15:48118 (RA;US)
Computer modeling of a CFB [circulating fluidized bed] gasifier: Third technical progress report, 15:48111 (R;US)
Heat transfer in a two-bed fluidized combustor, 15:48114 (R;US)
Load turndown in a two-bed fluidized combustor, 15:48116 (R;US)
Studies of materials erosion in coal conversion and utilization systems, 15:48117 (RA;US)
The erosion-corrosion of modified chromium steels, 15:48119 (RA;US)
Work in progress, 15:48120 (RA;US)
FLUIDS
See also GASES
LIQUIDS
Effects of jet port arrangement on three-dimensional non-reacting jet -gas mixing in an MHD second stage combustor, 15:48106 (R;US)
Equation of state in the acentric-factor system, 15:49043 (RA;US)
FLUORESCENCE SPECTROSCOPY
Lead carbonate: A new fast, heavy scintillator, 15:49321 (J;US)

FLUORIDES
See also CALCIUM FLUORIDES
LITHIUM FLUORIDES
NICKEL FLUORIDES
OSMIUM FLUORIDES
SILVER FLUORIDES
YTTRIUM FLUORIDES
A general method for the synthesis of polymeric binary fluorides exemplified by AgF_3, NiF_4, RuF_4, and OsF_4, 15:49099 (RA;US)
The preparation of planar-sheet graphite fluorides C_xF with $X < 2$, 15:48964 (RA;US)
Work in progress (Synthesis and examination of graphite-structure type compounds), 15:49106 (RA;US)

FLUORIMETRY
See FLUORESCENCE SPECTROSCOPY

FLUORINATED ALIPHATIC HYDROCARBONS
Gas-phase chemical reactivity of CFC-114 [Chloro-fluoro-carbons-114] and potential replacements: Part 1, CFC-114 reactivity with Fsub 2 and UFsub 6, 15:48216 (R;US)

FLUORINE
Determination of non-metallic elements in actinide complexes by oxygen flask combustion (OFC): chlorine and fluorine, 15:48989 (R;IN)

FLUORINE FLUORIDES
See FLUORINE

FLUORITE
Characterization of electron-beam-induced damage structures in natural fluorite, CaF_2, by analytical electron microscopy, 15:48960 (RA;US)

FLUOROSCOPY
Image field size and beam collimation in fluoroscopic equipment, 15:49669 (RA;GB)

FLUORS
See PHOSPHORS

FLUX (NEUTRON)
See NEUTRON FLUX

FLY ASH
Biological effects of combined exposure to coal fly ash and nitrogen dioxide. 3.: Morphological changes in respiratory organs of golden hamster, 15:48122 (R;JP;In Japanese)
Canada Brick Quarry ash landfill. Groundwater monitoring and control system modifications, 1989, 15:49604 (R;CA)
Experimental studies of the production of lightweight aggregate from fly ash/coal cleaning refuse mixtures, 15:48094 (R;US)
The stabilization and utilization of coal solid wastes, 15:48095 (R;US)

FOAMS
Emulsion stability and rigid foams from styrene or divinylbenzene water-in-oil emulsions, 15:49096 (J;US)
Foams for effective gas blockage in the presence of crude oil, 15:48134 (BA;US)

FOCK METHOD
See HARTREE-FOCK METHOD

FOCK SELF-CONSISTENT FIELD
See HARTREE-FOCK METHOD

FOOD CHAINS
Hanford Environmental Dose Reconstruction Project: Monthly report, August 1990, 15:49546 (R;US)
Health assessment for Fletcher's Paint Works and Storage Facility Hazardous Waste Material, Milford, Hillsborough County, New Hampshire, Region 1. CERCLIS No. NHD981067614. Preliminary report, 15:49615 (R;US)
Health assessment for Kent County Landfill (Houston), Houston, Kent County, Delaware, Region 3. CERCLIS No. DED980705727. Preliminary report, 15:49535 (R;US)
Superfund Record of Decision (EPA Region 1): New Bedford, MA. (First remedial action), March 1990, 15:49628 (R;US)

FOOD INDUSTRY
Non-waste technology - a challenge to biotechnology, 15:48827 (RA;FI)

FORCED CONVECTION
Infrasonic enhancement of heat transfer: Preliminary report, 15:49186 (R;CA)

FORESTRY
The optical parametrization of an aerial multispectral camera, 15:49599 (R;FI)

FORESTS
Differential seeding and regeneration in openings and beneath closed canopy in sub-tropical wet forest, 15:49568 (R;US)
Modeled sulfur deposition trends since 1990 in North America, 15:49456 (R;US)
Nitrate reductase is induced in red spruce by NO_2 and HNO_3 vapor, 15:49726 (J;US)

FORMALDEHYDE
Evaluation of emission factors for formaldehyde from certain wood processing operations. Final report, May-August 1989, 15:49543 (R;US)
The small-molecule limit of infrared multiphoton dissociation: Collisional effects in D_2CO, 15:49040 (RA;US)

FORMALIN
See FORMALDEHYDE

FORMALITH
See FORMALDEHYDE

FORMIC ALDEHYDE
See FORMALDEHYDE

FORMOL
See FORMALDEHYDE

FOSSIL FUEL RESERVES
See FOSSIL FUELS

FOSSIL FUELS
See also COAL
NATURAL GAS
OIL SANDS
OIL SHALES
PETROLEUM
SHALE OIL
A correlation for thermodynamic properties of heavy fossil-fuel fractions, 15:49066 (RA;US)
Correlation of liquid heat capacities for fossil fuels using characterization data, 15:49065 (RA;US)
Effects on the environment of the fuels we are using, 15:48746 (RA;CA)
Let's clear the air, 15:48842 (R;CA)
X-ray absorption spectroscopic study of vanadium sites in fossil fuels and model compounds, 15:48090 (BA;US)

FOSSIL-FUEL POWER PLANTS
Atikokan TGS aquatic studies, 1981 to 1988, II: Water chemistry, 15:48516 (R;CA)
Draft guidelines for an environmental impact assessment: N.B. Power, Millbank Generating Station, 15:48151 (R;CA)
Electrical generating station proposal: Complete verbatim transcript, 15:48515 (R;CA)
Electrostatic precipitators, 15:49555 (RA;FI)
Environmental review of Potomac Electric Power Company's proposed Station H Element I, 15:48155 (R;US)
Estimating the effect of generating unit age on EFOR [equivalent forced outage rate] and EAF [equivalent availability factor] for coal-fired steam units operating between 1964 and 1981, 15:48485 (R;US)
Metallurgical investigation of main-steam-line weldment cracking, Lakeview TGS, 15:48493 (R;CA)
Report and recommendations regarding the environmental-assessment report for the proposed Point Aconi electrical generating station, 15:48099 (R;CA)

FOULING
See also BIOLOGICAL FOULING
Mechanisms of surface enrichment and adhesion of coal combustion particulates: Sixth and seventh quarterly reports, December 16, 1987–June 15, 1988, 15:48112 (R;US)

FOUNDATIONS
A statistical comparison of uplift design methods for augered footings in sand, 15:48970 (R;CA)
Field evaluation of grillage foundation uplift capacity: Final report, 15:48674 (R;US)

FRACTURE MECHANICS
Research activities in materials assessment, selection and development, fracture mechanics and non-destructive testing in Switzerland, 15:48523 (RA;XA)
FRACTURE PROPERTIES
A continuum tensile failure model with friction, 15:49400 (R;US)
FRACTURE STRENGTH
See FRACTURE PROPERTIES
FRACTURE TOUGHNESS
See FRACTURE PROPERTIES
FRAGMENTS (FISSION)
See FISSION FRAGMENTS
FRAGMENTS (PARTICLES)
See PARTICLES
FRANCE
Development of charcoal making processes in France, 15:48424 (RA;LU)
FREE ELECTRON LASERS
Operational status of the Brookhaven National Laboratory Accelerator Test Facility, 15:49225 (R;US)
Review of free-electron lasers, 15:49216 (R;US)
Use of a FEL [free electron laser] as a buncher for a TBA [two-beam accelerator] scheme, 15:49238 (R;US)
FREE RADICALS
See RADICALS
FREONS
Final best demonstrated available technology (BDAT) background document for K021. Volume 6, 15:49480 (R;US)
FRESH WATER ECOSYSTEMS
See AQUATIC ECOSYSTEMS
FUEL ASSEMBLIES
Experimental research of local hydrodynamic characteristics of fast reactor fuel assembly peripheral zone. 7: Results of measurement in entry section of model, 15:48586 (R;CS;In Russian)
Experimental research of local hydrodynamic characteristics of fast reactor fuel assembly peripheral zone. 5: Results of measurement at group displacement. SPOGVY variants, 15:48584 (R;CS;In Russian)
Experimental research of local hydrodynamic characteristics of fast reactor fuel assembly peripheral zone. 6: Turbulent flow microstructure at a group displacement of the rods, 15:48585 (R;CS;In Russian)
ICARE, a computer code for severe fuel damage analysis - General description of the second version, ICARE2, 15:48534 (RA;XA)
FUEL CANS
Bias in peak clad temperature predictions due to uncertainties in modeling of ECC bypass and dissolved non-condensable gas phenomena, 15:48664 (R;US)
The MERLIN programme: Pt. 2, A description of the MERLIN rig, 15:48662 (R;GB)
FUEL CELL CATALYSTS
See ELECTROCATALYSTS
FUEL CELL POWER PLANTS
Molten carbonate fuel cell power plant systems studies, 15:48490 (R;US)
FUEL CELLS
See also ALCOHOL FUEL CELLS
ALKALINE ELECTROLYTE FUEL CELLS
HYDROCARBON FUEL CELLS
SOLID ELECTROLYTE FUEL CELLS
Proceedings of the second annual fuel cells contractors review meeting, 15:48760 (R;US)
FUEL COOLING INSTALLATIONS
See SPENT FUEL STORAGE
FUEL CYCLE
See also URANIUM RECYCLE
Enrichment and fuel cycle developments, 15:48250 (RA;XA)
Low enriched uranium fuel in CANDU reactors, 15:48252 (RA;XA)
The nuclear fuel cycle: review on R and D policies in the Member States of the European Communities, 15:48215 (R;FR)
FUEL ELEMENTS
See also FUEL PINS
FUEL RODS
The Neutron Radiography Reactor (NRAD), 15:48620 (R;US)
FUEL GAS
See also NATURAL GAS
Assessment of modular IGCC plants based on entrained flow coal gasification supplemental studies, 15:48489 (R;US)
FUEL MANAGEMENT
Prospects for the French nuclear fuel management, 15:48247 (RA;XA)
FUEL PELLETS
Study on centrifugal acceleration of hydrogen pellets, 15:50175 (R;SU;In Russian)
FUEL PENCILS
See FUEL PINS
FUEL PINS
Reactor transients tests for SNR fuel elements in HFR reactor, 15:48635 (RA;FR;In German)
Thermal-hydraulic impact of failure of highly irradiated fuel pins on LMR passive safety, 15:48641 (R;US)
FUEL REPROCESSING PLANTS
Consolidated fuel reprocessing program simulation of a continuous rotary dissolver, 15:48226 (BA;US)
Development of remote disassembly technology for liquid-metal reactor (LMR) fuel, 15:48579 (R;US)
Estimate of the source term for a repository surface facility from the routine processing of spent fuel, 15:48228 (BA;US)
Reprocessing input data validation, 15:48388 (R;US)
The search for advanced remote technology in fast reactor reprocessing, 15:48224 (R;US)
FUEL ROD CONSOLIDATION
See FUEL RODS
FUEL RODS
Experimental research of local hydrodynamic characteristics of fast reactor fuel assembly peripheral zone. 7: Results of measurement in entry section of model, 15:48586 (R;CS;In Russian)
Irradiation testing of SIEMENS/KWU LWR fuel in the HFR Petten, 15:48531 (RA;FR)
FUEL SHEATHS
See FUEL CANS
FUEL SLUGS
See FUEL RODS
FUELS
See also AUTOMOTIVE FUELS
FOSSIL FUELS
JET ENGINE FUELS
LIQUID FUELS
NUCLEAR FUELS
WOOD FUELS
International risk factors affecting Finnish energy supplies, 15:48742 (R;FI;In Finnish)
Utilization of resources of the wood pulping industry - a holistic view, 15:48826 (RA;FI)
FUELS (NUCLEAR)
See NUCLEAR FUELS
FUELWOOD
See WOOD FUELS
FUMES
See AEROSOLS
FUNCTION GENERATORS
Computer calculation of the powerful tube generator for accelerator HF power supply system, 15:49254 (R;SU;In Russian)
FUNDAMENTAL PARTICLES
See ELEMENTARY PARTICLES
FURNACES
See also WOOD BURNING FURNACES
Decontamination and decommissioning facility environmental assessment, Feed Materials Production Center, Fernald, Ohio, 15:48261 (R;US)
Selective steam cracking for energy and raw materials savings: Final report, 15:48137 (R;LU)

FUSED SALTS
See MOLTEN SALTS
FUSION (NUCLEAR)
See THERMONUCLEAR REACTIONS
FUSION ENERGY
See THERMONUCLEAR REACTORS
FUSION REACTIONS
See HEAVY ION FUSION REACTIONS
FUSION REACTORS
See THERMONUCLEAR REACTORS

G

G CODES
GITTAM program for numerical simulation of one-dimensional targets TIS. Part 2: 2. Description of algorithm and program, 15:50219 (R;SU;In Russian)
GITTAM program for numerical simulation of one-dimensional targets TIS. Part 3: 3. Testing calculations, 15:50178 (R;SU;In Russian)
Software for the ODRA and ODRENOK computers; programs for text file processing, 15:50220 (R;SU;In Russian)
GADOLINIUM BASE ALLOYS
Physical metallurgy and magnetic behavior of Cd stabilized bcc (beta)Gd alloys, 15:48881 (R;US)
GALACTIC EVOLUTION
A model for the distribution of dark matter, galaxies, and the intergalactic medium in a cold dark matter-dominated universe, 15:49838 (BA;US)
Galactic structure, 15:49833 (RA;ZA)
Primeval and rejuvenated galaxies: A new approach to the search for them, 15:49839 (BA;US)
GALAXIES
See also MAGELLANIC CLOUDS
MILKY WAY
Evolutionary synthesis of the far-infrared emission in starburst galaxies, 15:49802 (RA;FR)
Far-infrared fine-structure lines in active galaxies, 15:49807 (RA;FR)
Fluorescent molecular hydrogen emission from star-forming galaxies, 15:49805 (RA;FR)
Formation and dynamics of shell structures in the astrophysical systems under the accretion of gas on the source of wind activity, 15:49813 (R;UA;In Russian)
H53α emission from M82, 15:49806 (RA;FR)
Infrared profiles of five spiral galaxies, 15:49804 (RA;FR)
Infrared spectroscopy in astronomy: Proceedings of the 22 Eslab Symposium, 15:49750 (R;FR)
Infrared spectroscopy of star formation in galaxies: extreme conditions and very short time scales, 15:49797 (RA;FR)
Isocurvature baryon-dominated open universe - Structure of galactic halos, 15:49849 (J;US)
Near infrared spectroscopy of active galaxies, 15:49794 (RA;FR)
Near-infrared spectroscopy of starburst and interacting galaxies, 15:49795 (RA;FR)
Primeval and rejuvenated galaxies: A new approach to the search for them, 15:49839 (BA;US)
Spectroscopy of galaxies in the mid-infrared, 15:49796 (RA;FR)
The correlation between radio and far-infrared emission for disk galaxies, 15:49808 (RA;FR)
The strengths of the 2.3 μm CO band in luminous interacting and merging galaxies, 15:49798 (RA;FR)
GALAXY NUCLEI
A search for the CO feature in active galactic nuclei, 15:49801 (RA;FR)
Infrared [FEII], H and H_2 lines in galaxy nuclei, 15:49803 (RA;FR)
GALLIUM ARSENIDES
Electric-field dependent electroreflectance and photocurrent spectroscopy in InGaAs/InAlAs strained-layer superlattices, 15:48974 (R;US)
Formation and stability of As-H bonds in H-implanted GaAs, 15:49083 (R;US)
In-situ studies of ion irradiation effects in an electron microscope, 15:48985 (J;US)
Ion mixing of semiconductor superlattices, 15:48951 (R;US)
Nonparabolic conduction bands and masses in strained-single-quantum wells, 15:48975 (R;US)
Photoluminescence studies of $In_xGa_{1-x}As/Al_yGa_{1-y}As$ strained-layer structures: Effects of annealing, 15:48976 (R;US)
GAMMA CAMERAS
See also POSITRON CAMERAS
Design considerations for a single tube gamma camera, 15:49348 (J;US)
Three-dimensional imaging utilizing energy discrimination, 15:49703 (J;US)
GAMMA DETECTION
Processing of the information from gamma detector at SIGMA-AJAX setup, 15:49307 (R;SU;In Russian)
Statistical calibration and periodic performance checks for segmented gamma scanning, 15:48393 (R;US)
GAMMA LOGGING
Calculation of Monte Carlo importance functions for use in nuclear-well logging calculations, 15:49375 (J;US)
GAMMA SPECTROMETERS
A practical approach to ballistic deficit correction, 15:49335 (J;US)
GAMMA-RAY LASERS
See GASERS
GAS ANALYSIS
Acoustic wave chemical sensors based on monitoring both velocity and attenuation, 15:49387 (BA;US)
Catalytic gated semiconductor devices as gas sensors, 15:48980 (BA;US)
Micro-mirrors for gas sensing, 15:49388 (BA;US)
Real-time vapor monitoring with MS/MS, 15:49558 (BA;US)
SAW gas sensors based on acoustoelectric effects, 15:49123 (BA;US)
Vapor-phase measurements of volatile organochlorides using fiber optics, 15:49637 (BA;US)
GAS CENTRIFUGATION
Economics of low enriched uranium in China, 15:48251 (RA;XA)
GAS COOLANTS
See GASES
GAS ENGINES
See INTERNAL COMBUSTION ENGINES
GAS SCINTILLATION DETECTORS
High pressure gas scintillation drift chambers with wave-shifter fiber readout, 15:49345 (J;US)
GAS TURBINE ENGINES
Introducing the VRT gas turbine combustor, 15:49192 (R;US)
GAS TURBINES
Reference concepts for a space-based hydrogen-oxygen combustion, turboalternator, burst power system, 15:49406 (R;US)
Research and development of advanced gas turbine. Technical report, 15:48495 (R;JP)
GAS WELLS
See NATURAL GAS WELLS
GASEOUS DIFFUSION PROCESS
Economics of low enriched uranium in China, 15:48251 (RA;XA)
GASERS
SDIO/1st ultrashort wavelength laser - novel experimental schemes for observing the Moessbauer Effect in long-lived nuclear levels and nuclear coherent states. Final technical report for period ending 26 May 1990, 15:49200 (R;US)
GASES
See also AIR
COSMIC GASES
DISSOLVED GASES
EXHAUST GASES
FUEL GAS
PYROLYTIC GASES
Fabric filters: Filtermedia, 15:49553 (RA;FI)
Study of the options for reduction of energy-related greenhouse gas emissions, 15:49471 (RA;CA)
GASIFICATION
See also COAL GASIFICATION

Municipal solid waste feasibility of gasification with plasma arc: Phase 2. Environmental analyses, 15:48436 (RA;CA)

GASOLINE
In-situ biorestoration of a subsoil contaminated with gasoline. Interim report, 15:48156 (R;NL)
Upgrading Fischer-Tropsch naphtha, 15:48078 (R;US)

GASOLINE ENGINES
See INTERNAL COMBUSTION ENGINES

GATING CIRCUITS
32-input gating circuit for event selection, 15:49291 (R;SU;In Russian)

GAUGE INVARIANCE
On a generalization of the gauge principle at high energies, 15:49972 (R;SU;In Russian)

GAUGE TRANSFORMATIONS
See GAUGE INVARIANCE

GE SEMICONDUCTOR DETECTORS
A practical approach to ballistic deficit correction, 15:49335 (J;US)
Large coaxial germanium detectors, 15:49339 (J;US)
Possibility of experiments using radiation counters for test electron stability and Pauli principle violation in atoms, 15:49303 (R;SU;In Russian)
The HgI_2 energy dispersive x-ray array detectors and minaturized processing electronics project, 15:49325 (J;US)

GELS
Formation and pore structure of boron nitride aerogels, 15:48947 (J;US)
Solidification in cement of ion-exchange resins from LOMI [Low Oxidation State Metal Ion] decontamination: Final report, 15:48269 (R;US)

GENERAL RELATIVITY THEORY
General relativistic hydrodynamics and radiation transport, 15:50106 (BA;US)

GENERATORS (STEAM)
See STEAM GENERATORS

GENETIC ENGINEERING
Annual report and summaries of FY 1990 activities, 15:48413 (R;US)
Computer simulation of chemical reactions in synthetic model compounds and genetically engineered active sites. Final report, 1 July 1989-30 June 1990, 15:49641 (R;US)

GENETIC MAPPING
Development of a small gantry robotic workcell for deoxyribonucleic acid (DNA) filter array construction, 15:49644 (R;US)

GENETICS
Genetics and the unity of biology: Proceedings: Part 1 of 2, 15:49653 (R;CA)
Genetics and the unity of biology: Proceedings: Part 2 of 2, 15:49654 (R;CA)

GEOLOGIC ENGINEERING
See ENGINEERING GEOLOGY

GEOLOGIC FORMATIONS
Modeling of coupled heat-mass stress effects in geologic media, 15:48342 (BA;US)

GEOLOGIC FRACTURES
An investigation of the mechanical and hydrologic behavior of tuff fractures under saturated conditions, 15:48337 (BA;US)
Application of geophysical methods for fracture characterization, 15:48331 (BA;US)
Combined analytical/numerical approaches to solving fluid flow problems in the unsaturated zone at Yucca Mountain, 15:48338 (BA;US)
Seismic characterization of fracture properties, 15:48343 (BA;US)
The application of vertical seismic profiling and cross-hole tomographic imaging for fracture characterization at Yucca Mountain, 15:48330 (BA;US)

GEOLOGIC SURVEYS
Alluvial valley floor identification and study guidelines. Final report, 15:48103 (R;US)
Deep geology program in France, third research phase (1985-1986), 15:48477 (R;FR;In French)

GEOLOGICAL SURVEYS
See GEOLOGIC SURVEYS

GEOLOGY
See also ENGINEERING GEOLOGY
Iowa State Mining and Mineral Resources Research Institute final report, July 1, 1988–June 30, 1989, 15:49737 (R;US)
Iowa State Mining and Mineral Resources Research Institute: Semi-annual report, July 1, 1989–December 31, 1989, 15:49738 (R;US)

GEOMAGNETIC STORMS
See MAGNETIC STORMS

GEOMETRY
IGES efficiency evaluation, 15:50244 (R;US)

GEOPHONES
See SEISMIC DETECTORS

GEOPHYSICS
Numerical models of 2-D and 3-D geophysical convection, 15:49740 (R;US)

GEOTHERMAL ENERGY
Geothermics a 1982-1985 review, 15:48476 (R;FR;In French)

GEOTHERMAL EXPLORATION
Deep geology program in France, third research phase (1985-1986), 15:48477 (R;FR;In French)

GEOTHERMAL SYSTEMS
A numerical study of convection in a layered porous medium heated from below, 15:48478 (R;US)

GERMANIUM
Application of ion beam sputtering for diffusion study in solids, 15:50065 (R;GB)
Damped-core quantum Monte Carlo: An effective treatment for large-z systems, 15:50233 (RA;US)
Infrared absorption study of neutron-transmutation-doped germanium, 15:49074 (RA;US)
Study of the fundamental linewidths of 1S $\rightarrow$ nP donor transitions in ultrapure germanium, 15:48966 (RA;US)

GERMANIUM ALLOYS
Structure of amorphous-silicon and germanium alloy films: Annual subcontract report, January 15, 1989–January 14, 1990, 15:48463 (R;US)

GERMANIUM ARSENIDES
Quasiparticle calculation of valence-band offset of AlAs-GaAs(001), 15:50085 (RA;US)

GERMANIUM DETECTORS
See GE SEMICONDUCTOR DETECTORS

GERMANIUM PHOSPHIDES
Surface geometry of (1 x 1)PH_x/Ge(111) determined with angle-resolved photoemission extended fine structure, 15:48963 (RA;US)

GERMANIUM SULFIDES
Surface bonding geometry of (2 x 1)S/Ge(001) by normal-emission angle-resolved photoemission extended fine structure, 15:48962 (RA;US)

GIANT STARS
CO infrared bands in atmospheres of long-period variables, 15:49783 (RA;FR)
Infrared spectroscopy of late-type stars, 15:49776 (RA;FR)
Observations of 40-70 μm bands of ice in IRAS 09371+1212 and other stars, 15:49788 (RA;FR)

GLASS
See also BOROSILICATE GLASS
PHOSPHATE GLASS
Mass-transfer anaylsis of waste packages containing defense waste processing facility glass as a waste form, 15:48315 (BA;US)
Recent results of the effects of gamma radiation on the durability and microstructure of DWPF glass, 15:48982 (BA;US)
Vapor hydration and subsequent leaching of transuranic-containing SRL and WV glasses, 15:48981 (BA;US)

GLASSY METALS
See METALLIC GLASSES

GLUON-GLUON INTERACTIONS
Resummation and the gluon damping rate in hot QCD, 15:49918 (R;US)

GLUONS
Model of chromoelectric charges confinement, 15:49930 (R;SU)

Numerical study of equation for gluonic cascade with recombination, 15:49936 (R;SU)
Searching for 100–300 GeV gluinos at the Tevatron and SSC, 15:49907 (R;US)

GOBAR GAS
See METHANE

GOLD
Application of ion beam sputtering for diffusion study in solids, 15:50065 (R;GB)
Structure of Au and Pt films on Pd(110): Deposition temperature and coverage dependent (1 times 2) and (1 times 3) reconstructions, 15:48878 (R;US)

GOLD ISOTOPES
Laser spectroscopy of laser-desorbed gold isotopes, 15:50073 (R;FR)

GOVERNMENT POLICIES
See also ENVIRONMENTAL POLICY
Invitation business of experts in alternative energy, 15:48731 (R;JP;In Japanese)

GRAIN ALCOHOL
See ETHANOL

GRAIN BOUNDARIES
Molecular-dynamics study of grain-boundary migration in metals, 15:48860 (R;US)

GRANITES
Hydrothermal alterations as natural analogues of radionuclide migration in granitic rocks, 15:48272 (R;FR;In French)
Laboratory particle-velocity experiments on rock from a USSR underground nuclear test site. Technical report, 15:49396 (R;US)

GRAPHITE
Corrosion protection of metal-matrix composites. Final report, October 1986-April 1990, 15:48855 (R;US)
HTR components irradiation tests. Actual state and future requirements, 15:48634 (RA;FR;In German)
Irradiation creep of graphite, 15:48600 (R;US)
KFA Neutron irradiation programme on materials for high heat load components of fusion devices, 15:50171 (RA;FR)
The preparation of planar-sheet graphite fluorides C_xF with $X < 2$, 15:48964 (RA;US)

GRAPHITE FIBERS
See CARBON FIBERS

GRAPHITE MODERATOR
See GRAPHITE

GRASERS
See GASERS

GRAVIMELT PROCESS
Molten-caustic-leaching (Gravimelt) system integration project: Quarterly report, January–March 1990, 15:48079 (R;US)

GRAVITATIONAL FIELDS
Tensor lost in general relativity theory, 15:50100 (R;SU;In Russian)
The energy problem in GR and tensor analysis, 15:50099 (R;SU;In Russian)

GRAVITATIONAL LENSES
Correlation function of gravitational deflection angles of light paths, 15:50105 (R;JP)

GRAVITATIONAL RADIATION
Unified geometric theory of gravitation and electromagnetism: 5. Gravitational collapse and scalar radiation, 15:49810 (R;SU;In Russian)

GREAT LAKES REGION
See FEDERAL REGION V

GREECE
The LEBEN - Project (Greece): Regional energy plan for Evrytania, 15:48727 (RA;LU)

GREENHOUSE EFFECT
Environmental Impacts
Atmospheric trends and emissions of greenhouse gases, 15:49420 (RA;US)
China's perspective: Impact of greenhouse warming and response strategies, 15:49448 (RA;US)
Climate change and US water resources, 15:49434 (RA;US)
Climate change and energy use: Role of renewable energy sources, 15:49430 (RA;US)
Coastal reforestation and agroforestry as immediate ameliorative measures to address global warming and to promote sustainable habitation of low-lying and coastal areas, 15:49435 (RA;US)
Combatting the greenhouse effect: Philippine style, 15:49446 (RA;US)
Coping with sea level rise, 15:49439 (RA;US)
Developing countries and climate change: Implications for risk management, 15:49422 (RA;US)
Effects of global warming on South Pacific Islands, 1900-2100, 15:49442 (RA;US)
Energy consumption and generation of greenhouse gases in Hong Kong, 15:49447 (RA;US)
Future coal use in the Asia/Pacific region, 15:49427 (RA;US)
Future patterns of electricity generation in Asia: Competing fuels and competing objectives, 15:49428 (RA;US)
Global climate change and activities of UNEP [United Nations Environment Programme], 15:49425 (RA;US)
Global climate change and coastal zone management in Bangladesh: Issues and options, 15:49441 (RA;US)
Global warming and Bangladesh: Implications and responses, 15:49453 (RA;US)
Global warming and rise in sea level in the south Asian seas region, 15:49438 (RA;US)
Global warming, tropical cyclones and ENSO [El Nino - Southern Oscillation], 15:49421 (RA;US)
Global warming: Australian impacts and responses, 15:49449 (RA;US)
Global warming: Perspectives on India's energy policies and responses to climate change, 15:49443 (RA;US)
Implications of climate change for energy policies in Asia, 15:49426 (RA;US)
Korea's energy policy and its environmental implications, 15:49451 (RA;US)
Malaysia's response to global climate change, 15:49445 (RA;US)
Mitigating climate change: Strategies to finance retention of tropical forests, 15:49433 (RA;US)
New Zealand's response to global climate change, 15:49450 (RA;US)
Oceanic CO_2 uptake and future atmospheric CO_2 concentrations, 15:49589 (R;US)
Opening remarks on behalf of Argonne National Laboratory, 15:49419 (RA;US)
Opening remarks on behalf of the East-West center, 15:49418 (RA;US)
Priority setting of strategies for limiting global warming, 15:49423 (RA;US)
Report of working group A: Priorities for research in sea-level rise, 15:49440 (RA;US)
Report of working group B: Priorities for research in agriculture and forestry, 15:49436 (RA;US)
Report of working group C: Priorities for research in energy policies, 15:49431 (RA;US)
Report of working group D: Priorities for research in risk management, 15:49424 (RA;US)
Responding to the threat of global warming: Options for the Pacific and Asia, 15:49454 (RA;US)
Reversing the atmospheric temperature warming in Taiwan, 15:49452 (RA;US)
Sea-level rise: Assessing the scientific debate, 15:49437 (RA;US)
The Japanese response to global warming - background, policy and research work, 15:49444 (RA;US)
The effects of a rapid global warming: Garden of eden or global impoverishment?, 15:49432 (RA;US)
US energy use: New technologies and policies in response to global warming, 15:49429 (RA;US)

Meetings
Atmospheric trends and emissions of greenhouse gases, 15:49420 (RA;US)
China's perspective: Impact of greenhouse warming and response strategies, 15:49448 (RA;US)
Climate change and US water resources, 15:49434 (RA;US)

Climate change and energy use: Role of renewable energy sources, 15:49430 (RA;US)
Coastal reforestation and agroforestry as immediate ameliorative measures to address global warming and to promote sustainable habitation of low-lying and coastal areas, 15:49435 (RA;US)
Combatting the greenhouse effect: Philippine style, 15:49446 (RA;US)
Coping with sea level rise, 15:49439 (RA;US)
Developing countries and climate change: Implications for risk management, 15:49422 (RA;US)
Effects of global warming on South Pacific Islands, 1900-2100, 15:49442 (RA;US)
Energy consumption and generation of greenhouse gases in Hong Kong, 15:49447 (RA;US)
Future coal use in the Asia/Pacific region, 15:49427 (RA;US)
Future patterns of electricity generation in Asia: Competing fuels and competing objectives, 15:49428 (RA;US)
Global climate change and activities of UNEP [United Nations Environment Programme], 15:49425 (RA;US)
Global climate change and coastal zone management in Bangladesh: Issues and options, 15:49441 (RA;US)
Global warming and Bangladesh: Implications and responses, 15:49453 (RA;US)
Global warming and rise in sea level in the south Asian seas region, 15:49438 (RA;US)
Global warming, tropical cyclones and ENSO [El Nino - Southern Oscillation], 15:49421 (RA;US)
Global warming: Australian impacts and responses, 15:49449 (RA;US)
Global warming: Perspectives on India's energy policies and responses to climate change, 15:49443 (RA;US)
Implications of climate change for energy policies in Asia, 15:49426 (RA;US)
Korea's energy policy and its environmental implications, 15:49451 (RA;US)
Malaysia's response to global climate change, 15:49445 (RA;US)
Mitigating climate change: Strategies to finance retention of tropical forests, 15:49433 (RA;US)
New Zealand's response to global climate change, 15:49450 (RA;US)
Opening remarks on behalf of Argonne National Laboratory, 15:49419 (RA;US)
Opening remarks on behalf of the East-West center, 15:49418 (RA;US)
Priority setting of strategies for limiting global warming, 15:49423 (RA;US)
Report of working group A: Priorities for research in sea-level rise, 15:49440 (RA;US)
Report of working group B: Priorities for research in agriculture and forestry, 15:49436 (RA;US)
Report of working group C: Priorities for research in energy policies, 15:49431 (RA;US)
Report of working group D: Priorities for research in risk management, 15:49424 (RA;US)
Responding to the threat of global warming: Options for the Pacific and Asia, 15:49454 (RA;US)
Reversing the atmospheric temperature warming in Taiwan, 15:49452 (RA;US)
Sea-level rise: Assessing the scientific debate, 15:49437 (RA;US)
The Japanese response to global warming - background, policy and research work, 15:49444 (RA;US)
The effects of a rapid global warming: Garden of eden or global impoverishment?, 15:49432 (RA;US)
US energy use: New technologies and policies in response to global warming, 15:49429 (RA;US)

Risk Assessment
Priority setting of strategies for limiting global warming, 15:49423 (RA;US)

GREENHOUSES
Evaluation of dehumidifiers in a rose greenhouse, 15:48789 (R;CA)

GREENLAND
A new field experiment in the Greenland ice cap to test Newton's inverse square law, 15:50107 (BA;US)

GROUND COVER
Soil erosion rates from mixed soil and gravel surfaces in a wind tunnel, 15:49584 (R;US)

GROUND SOURCE HEAT PUMPS
Engineering manual for the design and installation of ground and water source heat pump systems: Volume 1, 15:48769 (R;CA)
Geothermal ground-loop preinstallation project at Walden Pond: Final report, 15:48780 (R;US)
Installer's manual for the design and installation of ground and water source heat pump systems: Volume 2, 15:48770 (R;CA)

GROUND WATER
Contamination
Delegation of remedy selection to regions. Directive (Final), 15:49580 (R;US)
Health assessment for Cinnaminson Township (Block 702) Ground-Water Contamination, Cinnaminson, Burlington County, New Jersey, Region 2. CERCLIS No. NJD980785638. Final report, 15:49621 (R;US)
Health assessment for Elizabethtown Landfill, Elizabethtown, Lancaster County, Pennsylvania, Region 3. CERCLIS No. PAD980539712. Final report, 15:49614 (R;US)
Health assessment for Ewan Property, Shamong Township, Burlington County, New Jersey, Region 2. CERCLIS No. NJD980761365. Final report, 15:49626 (R;US)
Health assessment for Fletcher's Paint Works and Storage Facility Hazardous Waste Material, Milford, Hillsborough County, New Hampshire, Region 1. CERCLIS No. NHD981067614. Preliminary report, 15:49615 (R;US)
Health assessment for GBF, Inc., Dump, Antioch, Contra Costa County, California, Region 9. CERCLIS No. CAD980498562. Preliminary report, 15:49620 (R;US)
Health assessment for Gautier Oil Co., Inc., Gautier, Mississippi, Region 4. CERCLIS No.MSD098596489. Preliminary report, 15:49534 (R;US)
Health assessment for Imperial Oil Co., Inc./Champion Chemicals, Marlboro Township, Monmouth County, New Jersey, Region 2. CERCLIS No. NJD980654099. Final report, 15:49624 (R;US)
Health assessment for Intersil, Inc./Siemens Components, Cupertino, Santa Clara County, California, Region 9. CERCLIS No. CAD041472341. Preliminary report, 15:49627 (R;US)
Health assessment for Kent County Landfill (Houston), Houston, Kent County, Delaware, Region 3. CERCLIS No. DED980705727. Preliminary report, 15:49535 (R;US)
Health assessment for Landfill and Development Company, Mount Holly, New Jersey, Region 2. CERCLIS No. NJD048044325. Final report, 15:49611 (R;US)
Health assessment for Occidental Chemical Corporation Site, Lower Pottsgrove Township, Montgomery County, Pennsylvania, Region 3. CERCLIS No. PAD980229298. Preliminary report, 15:49623 (R;US)
Health assessment for Radiation Technology, Inc., Rockaway, Morris County, New Jersey, Region 2. CERCLIS No. NJD047684451. Final report, 15:49625 (R;US)
Health assessment for Recticon/Allied Steel Corporation, Parkerford, Chester County, Pennsylvania, Region 3. CERCLIS No. PAD053302865. Preliminary report, 15:49533 (R;US)
Health assessment for Rose Hill Regional Landfill, South Kingstown, Rhode Island, Region 1. CERCLIS No. RID980521025. Preliminary report, 15:49622 (R;US)
Health assessment for South Municipal Water Supply Well, Hillsborough County, Peterborough, Cheshire County, New Hampshire, Region 1. CERCLIS No. NHD980671069. Final report, 15:49616 (R;US)
Health assessment for Tex Tin Corporation, National Priorities List Site, Texas City, Texas, Region 6. CERCLIS No. TXD062113329. Preliminary report, 15:49617 (R;US)
Health assessment for Tri-City Industrial Disposal Site, Brooks, Kentucky, Region 4. CERCLIS No. KYD981028350. Preliminary report, 15:49619 (R;US)

Health assessment for Union Carbide Disposal/Red Oak Landfill Site, Red Oak, Iowa, Region 7. CERCLIS No. IAD980643509. Preliminary report, 15:49539 (R;US)
Plains hydrology and reclamation project: Spoil ground-water chemistry and its impacts on surface water, 15:48098 (R;CA)
Superfund Record of Decision (EPA Region 3): C and R Battery, VA. (First remedial action), March 1990. Final report, 15:49629 (R;US)

Monitoring
Liquid effluent study project plan: Environmental and waste management: Revision 2, 15:48293 (R;US)

Radionuclide Migration
Determination of diffusion coefficients in cohesive and sandy sediment from the area of Gorleben, 15:49597 (RA;DE;In German)
Influence of humic acids on the solubility and sorption characteristics of inorganic cations as exemplified by Cs, Sr, Zr and Nb, 15:49596 (RA;DE;In German)
Natural radionuclides in groundwater from J-13 well at the Nevada test site, 15:48310 (BA;US)
Red Canyon wash infiltration studies, 15:49592 (R;US)

Sampling
Performance evaluation of a groundwater and soil gas remedial action, 15:49566 (R;US)

Tritium
Hydrogeological investigations at the Asse salt mine, 15:48282 (RA;DE;In German)
Low-level tritium measurements in groundwater samples from Stripa-Pluton (Sweden), 15:49598 (RA;DE;In German)

Water Chemistry
Canada Brick Quarry Ground Water Survey 8th annual report, 1988-1989, 15:49605 (R;CA)

Water Pollution
Annual report 1988 of the GSF Institute of Hydrology, 15:49594 (R;DE;In German)

GROUND-WATER RESERVES
See AQUIFERS

GROUNDNUTS
See PEANUTS

GULF OF MEXICO
Gulf of Mexico Sales 131, 135, and 137: Central, western and eastern planning areas: Final environmental impact statement: Volume 1, Sections I through IV.C, 15:48705 (R;US)

GYPSUM
Investigations on the diffusion of inorganic pollutants in selected sediments from the Asse cap rock and in clay samples from the Niederwallach landfill, 15:49459 (RA;DE;In German)

H

H1 REGIONS
An implication of the IR identification of PAHs: the heating of the diffuse is gas, 15:49774 (RA;FR)

H2 REGIONS
Molecular hydrogen in the HII region G333.6-0.2, 15:49769 (RA;FR)
Polycyclic aromatic hydrocarbons in the infrared spectra of IRAS sources, 15:49765 (RA;FR)

HADRON REACTIONS
Generalized radiative corrections for hadronic targets, 15:49922 (R;FR;In French)
Partial inelasticity coefficients in hadron-nucleus interactions, 15:50045 (RA;SU;In Russian)

HADRON-HADRON INTERACTIONS
See also MESON-MESON INTERACTIONS
An off-energy description of hadron-hadron interaction within the P-matrix approach, 15:49945 (R;UA)

HADRONS
See also BARYONS
MESONS
Effective methods in QCD and the phenomenology of hadrons, 15:49920 (R;FR)
Measurement of α_s from energy-energy correlations in e^+e^- annihilation at 29 GeV, 15:49912 (R;US)

HAFNIUM 178
Description of low-lying vibrational $K^\pi \neq 0^+$ states of deformed nuclei in the quasiparticle-phonon nuclear model, 15:50041 (R;SU)

HALOGENATED ALIPHATIC HYDROCARBONS
See also CHLORINATED ALIPHATIC HYDROCARBONS
FLUORINATED ALIPHATIC HYDROCARBONS
FREONS
Final response to BDAT related comments document. Mixed radioactive hazardous wastes, polynuclear aromatic u wastes, halogenated aliphatic U wastes, non-halogenated aromatic U wastes, F002-f006, F019. Volume 1-J, 15:49525 (R;US)

HANDLING (WASTES)
See WASTE MANAGEMENT

HANFORD RESERVATION
An overview of the vitrification of defense high-level waste at the Hanford site, 15:48340 (BA;US)
Diffusion coefficients and hydraulic conductivity in unsaturated Hanford soils and sediments, 15:48336 (BA;US)
Liquid effluent study project plan: Environmental and waste management: Revision 2, 15:48293 (R;US)
State of Washington Department of Health, radioactive air emissions Permit FF01: Supplemental information, 15:48618 (R;US)

HARDNESS
Indentation testing of thin films and hard materials, 15:48912 (R;US)

HARTREE APPROXIMATION
See HARTREE-FOCK METHOD

HARTREE-FOCK METHOD
Functionals Hartree-Fock equations in the Schrodinger representation of quantum field theory, 15:50094 (R;BR)
Hartree-Fock integral method, 15:49862 (RA;BR;In Portuguese)

HAZARDOUS MATERIALS

Biodegradation
Use of Office of Research and Development's bioremediation expertise in Superfund removal program. Directive (Final), 15:48159 (R;US)

Chemical Analysis
Fiber optic spectrochemical emission sensor: A detector for chlorinated and fluorinated compounds, 15:49638 (BA;US)

Combustion
Reuse of incinerated soil residues in land reclamation, 15:49567 (R;US)

Ecological Concentration
Chemical use and distribution in the Regina aquifer region. Volume I: Executive Summary – Volume II: Report and appendices, 15:49602 (R;CA)

Environmental Exposure Pathway
Multimedia Environmental Pollutant Assessment System (MEPAS) application guidance: Volume 1, User's guide, 15:49548 (R;US)

Ground Disposal
Nonradioactive dangerous waste landfill closure/postclosure plan, 15:48263 (R;US)

Health Hazards
Multimedia Environmental Pollutant Assessment System (MEPAS) application guidance: Volume 2, Guidelines for evaluating MEPAS input parameters, 15:49583 (R;US)
Supplemental mathematical formulations: The Multimedia Environmental Pollutant Assessment System (MEPAS), 15:49547 (R;US)

Standards
Best demonstrated available technology (BDAT) background document for U and P wastes and multisource leachates. Volume D. Reactive U and P waste waters and nonwaste waters. Final report, 15:49501 (R;US)
Best demonstrated available technology (BDAT) background document for wastes, 15:49498 (R;US)
Best demonstrated available technology (BDAT) background document. Final, May 1990, 15:49474 (R;US)
Final best demonstrated available technology (BDAT) background document for K073. Volume 5, 15:49479 (R;US)

Final best demonstrated available technology (BDAT) background document for K086 (ink-formulation-equipment cleaning wastes). Volume 7, 15:49481 (R;US)
Final best demonstrated available technology (BDAT) background document for characteristic ignitable wastes (D001), characteristic corrosive wastes (d002), characteristic reactive wastes (D003), and P and U wastes containing reactive listing constituents. Volume 2, 15:49476 (R;US)
Final response to BDAT related comments document, 15:49515 (R;US)
Final response to BDAT related comments document. Volume 1A-1. General BDAT issues, 15:49577 (R;US)
Final response to BDAT related comments document: D001. Volume 1-B, 15:49607 (R;US)
Final response to BDAT related comments document: D002. Volume 1-C, 15:49518 (R;US)

Waste Management
Background document for Third Third wastes to support 40 CFR part 268 land-disposal restrictions. Final rule. Third Third waste volumes, characteristics, and required and available treatment capacity. Volume 1. Executive summary. Chapter 1 and Chapter 2, 15:49578 (R;US)
Background document for Third Third wastes to support 40 CFR part 268 land-disposal restrictions. Final rule. Third Third waste volumes, characteristics, and required and available treatment capacity. Volume 2. Chapter 3, 15:49579 (R;US)
Background document for Third Third wastes to support 40 CFR part 268 land-disposal restrictions. Final rule. Third Third waste volumes, characteristics, and required and available treatment capacity. Volume 3. Chapter 4. Appendix A-Appendix I, 15:49609 (R;US)
RI/FS improvements follow-up. Final report, 15:48709 (R;US)

HCLWR TYPE REACTORS
Present status and subjects of research on heat removal in high conversion light water reactors, 15:48570 (RA;JP;In Japanese)

HD 8077
See NICKEL BASE ALLOYS

HDO
See HEAVY WATER

HEALTH PHYSICS
See RADIATION PROTECTION

HEAT
Development of an energy management system, 15:48831 (R;FI;In Finnish)

HEAT EXCHANGERS
See also FLUIDIZED BED HEAT EXCHANGERS
Deposition, corrosion, erosion and sulfur emission studies related to coal combustion: Annual report, 15:48109 (R;US)
Evaluation of a high-temperature burner-duct-recuperator system: A technical case study, 15:48806 (R;US)
Measurement of the longitudinal thermal conductivity for spiral tube-fin heat exchanger structure for helium facilities, 15:49181 (R;SU;In Russian)
Multi-stage solid absorption heat transformers for recovery of industrial waste heat: Final report, 15:48810 (R;LU)
Thermal performance analysis for heat exchangers using nonazeotropic refrigerant mixtures, 15:48772 (R;US)
Tubeside evaporation of nonazeotropic refrigerant mixtures from two enhanced surfaces, 15:48773 (R;US)

HEAT PIPES
Bench-scale testing of a heat-pipe receiver for solar thermal electric applications, 15:48470 (R;US)
Thermal analysis of heat-pipe radiators with a rectangular groove wick structure. Master's thesis, 15:49159 (R;US)

HEAT PUMPS
See also GROUND SOURCE HEAT PUMPS
WATER SOURCE HEAT PUMPS
Absorption heat pumps: Proceedings of a workshop, 15:48807 (R;LU)
Dynamic study of solid adsorption heat pumps: Experiments and numerical simulation economic analysis for development: Final report, 15:48781 (R;LU)
Heat pumps gain popularity solving more farm needs, 15:48814 (R;CA)
Japanese power electronics inverter technology and its impact on the American air conditioning industry, 15:48793 (R;US)
Multi-stage solid absorption heat transformers for recovery of industrial waste heat: Final report, 15:48810 (R;LU)
Performances of four magnetic heat-pump cycles, 15:49161 (R;US)

HEAT RECOVERY EQUIPMENT
Evaluation of a high-temperature burner-duct-recuperator system: A technical case study, 15:48806 (R;US)
Industrial processes: Proceedings of a contractors' meeting, 15:48809 (R;LU)

HEAT SOURCES (RADIOISOTOPE)
See RADIOISOTOPE HEAT SOURCES

HEAT STORAGE DEVICES
See THERMAL ENERGY STORAGE EQUIPMENT

HEAT STORAGE SYSTEMS
See THERMAL ENERGY STORAGE EQUIPMENT

HEAT TRANSFER
See also CONVECTION
Infrasonic enhancement of heat transfer: Preliminary report, 15:49186 (R;CA)
The dynamics of magma transport and eruption processes: An overview of recent developments, 15:49743 (R;US)

HEAT TRANSMISSION
See HEAT TRANSFER

HEAVY ION FUSION REACTIONS
GITTAM code for numerical simulation of one-dimensional targets for heavy ion fusion. Part 1: Pt.1 System of equations, 15:50177 (R;SU;In Russian)

HEAVY ION LINEAR ACCELERATORS
See HILACS

HEAVY ION REACTIONS
See also ARGON 40 REACTIONS
KRYPTON 84 REACTIONS
NEON 20 REACTIONS
NICKEL 58 REACTIONS
NITROGEN 14 REACTIONS
XENON 132 REACTIONS
Charged pion production in nucleus-nucleus collisions AT E/A between 400 and 800 MeV, 15:49982 (R;FR;In French)
Determination of number of interacting nucleons in the nuclear pionization model, 15:50047 (R;SU;In Russian)
Filamentation in quark plasma at finite temperatures, 15:49925 (R;SU;In Russian)
Heavy ion transfer reactions: Status and prospects, 15:50024 (R;US)
K^--meson production in relativistic nuclear collisions and nuclear pionization model, 15:50044 (RA;SU;In Russian)
On the strange particle production in the nuclear pionization model, 15:50043 (R;SU;In Russian)
Proceedings of the workshop on heavy ion physics at the Alternating Gradient Synchrotron (AGS), 15:49978 (R;US)
Simulation of angle interval distribution in collisions of relativistic nuclei and comparison with experiment, 15:50046 (RA;SU;In Russian)
Towards high-density matter with relativistic heavy-ion collisions, 15:50030 (R;JP)

HEAVY ION SPECTROMETERS
High dynamic range discriminator for measurements with fragmented heavy ions, 15:49341 (J;US)

HEAVY IONS
A large-area, scintillation telescope for heavy ions, 15:49328 (J;US)
A many particle-tracking detector with drift planes and segmentel cathode readout, 15:49267 (J;US)
A study of wire chambers with highly segmented cathode pad readout for high multiplicity charged particle detection, 15:49323 (J;US)

HEAVY OILS
See PETROLEUM

HEAVY WATER
Analysis of the published calorimetric evidence for electrochemical fusion of deuterium in palladium. Technical report, 15:50108 (R;US)

High-resolution photoionization spectrum of water molecules in a supersonic beam, 15:49135 (RA;US)

HEAVY WATER COOLANT
See HEAVY WATER

HEAVY WATER COOLED REACTORS
See also JRR-3 REACTOR
SPERT-2 REACTOR
Practical application of passive safety features for the advanced neutron source cooling system, 15:48642 (R;US)

HEAVY WATER MODERATOR
See HEAVY WATER

HELIOTRON
Loss cone region in toroidal helical systems, 15:50181 (R;JP)

HELIUM
Development of a detailed core flow analysis code for prismatic fuel reactors, 15:48572 (R;US)

HELIUM 3
Low temperature susceptibility of large molar volume bcc solid ^{3}He, 15:49867 (R;FR)
Production of high energy nuclei ^{4}He,^{3}He,^{3}H,^{2}H in interaction 10.1 GeV/c protons with Be,Al,Cu,Ta, 15:50032 (R;SU)
Vacancies in BCC solid ^{3}He, 15:49866 (R;FR)

HELIUM 3 TARGET
Comparison of theoretical and phenomenological phase shifts for $^{3}He(\alpha,\alpha)^{3}He$ scattering at ^{7}Be excitation range between 25 and 42 MeV, 15:50034 (R;UA)

HELIUM 4 TARGET
Resonating-group method in calculations of low-energy reactions and $n^{4}He$ scattering with realistic NN interactions, 15:50026 (R;SU;In Russian)

HELIUM 7
Neutron-rich isotopes of the lightest elements, 15:49991 (R;SU)

HELIUM 9
Neutron-rich isotopes of the lightest elements, 15:49991 (R;SU)

HEMOGLOBIN
EPR studies of photolysis of HbNO at low temperatures, 15:50067 (R;BR)
Fluorescence line-narrowing spectral analysis of in vivo human hemoglobin-benzo[a]pyrene adducts: Comparison to synthetic analogues, 15:49646 (BA;US)

HEREDITY
See GENETICS

HETEROJUNCTIONS
Quasiparticle calculation of valence-band offset of AlAs-GaAs(001), 15:50085 (RA;US)

HEXENES
Dissociation of cyclohexene and 1,4-cyclohexadiene in a molecular beam, 15:49141 (RA;US)

HFR REACTOR
Application of reactor neutrons for activation analysis, 15:48626 (RA;FR)
High flux reactor Petten present and future programme, 15:48622 (RA;FR)
Irradiation program of the transuranium European institute in the HFR reactor, 15:48633 (RA;FR;In French)
Neutron scattering in solid state physics and materials science, 15:48625 (RA;FR)
Nuclear physics at the HFR, 15:48624 (RA;FR)
Prospects and future utilization, 15:48621 (R;FR;In EN, DE)
Reactor transients tests for SNR fuel elements in HFR reactor, 15:48635 (RA;FR;In German)
The HFR as research tool. Operation, maintenance and upgrading, 15:48623 (RA;FR)

HGI2 SEMICONDUCTOR DETECTORS
The HgI_2 energy dispersive x-ray array detectors and minaturized processing electronics project, 15:49325 (J;US)

HIGH ENERGY PHYSICS
A proposed scalable parallel open architecture data acquisition system for low to high rate experiments, test beams and all SSC detectors, 15:49274 (J;US)
Improved charge collection of the buried p-i-n- a-Si:H radiation, 15:49324 (J;US)
New scintillation materials for high energy physics applications, 15:49329 (J;US)
Proceedings of the seminar of young scientists HEPI AN Kaz SSR. Part 1: 1. High energy physics and computer technique, 15:49901 (R;SU;In Russian)
Silcon microstrip electronics operating with 20 nsec FWHM signals, 15:49358 (J;US)
Task A, High energy physics program experiment and theory: Task B, High energy physics program numerical simulation: Part 1 and 2, Progress report August 1, 1989–July 31, 1990, 15:49900 (R;US)
Use of fiber-optics for real-time control and data acquisition, 15:49270 (J;US)

HIGH ENERGY RADIOTHERAPY
See RADIOTHERAPY

HIGH FLUX NEUTRON SOURCE FACILITY
See NEUTRON SOURCE FACILITIES

HIGH FLUX REACTOR PETTEN
See HFR REACTOR

HIGH TEMPERATURE GAS COOLED AND GRAPHITE MODERATED REACTORS
See HTGR TYPE REACTORS

HIGH VOLTAGE ALTERNATING CURRENT SYSTEMS
See HVAC SYSTEMS

HIGH-LEVEL RADIOACTIVE WASTES

Containers
An innovative cask for transporting defense high-level waste, 15:49171 (BA;US)
Fabrication and closure development of nuclear waste containers for storage at the Yucca Mountain, Nevada repository, 15:48369 (BA;US)
The use of performance assessments in Yucca Mountain repository waste package design activities, 15:48354 (BA;US)

Decontamination
Soluble high-level waste decontamination and disposal at the Savannah River Site, 15:48352 (BA;US)

Emission
Deposition of airborne particles from fractured spent fuel or high-level waste, 15:48374 (BA;US)

Ground Disposal
High-level radwaste plans in nine countries, 15:48371 (J;US)

Monitored Retrievable Storage
Current social systems issues in the U.S. high level waste management program, 15:48322 (BA;US)
Preliminary conceptual design description of the proposed DOE store-only monitored retrievable storage (MRS) facility, 15:48357 (BA;US)

Radioactive Waste Disposal
Linkage between site characterization program and performance and design data needs, 15:48359 (BA;US)
Social issues and challenges in the disposal of nuclear waste, 15:48363 (BA;US)

Radioactive Waste Processing
High level radioactive waste management at the Savannah River Site, 15:48329 (BA;US)
The technical review group: An application of the quality assurance program descriptions for defense high-level waste processing, 15:48351 (BA;US)

Underground Disposal
A description and status of the Yucca Mountain Project repository sealing program, 15:48323 (BA;US)
A waste package strategy for regulatory compliance, 15:48321 (BA;US)
Environmental program overview for a high-level radioactive waste repository at Yucca Mountain (Yucca Mountain Project), 15:48268 (R;US)
Hydrologic characterization of faults and other potentially conductive geologic features in the unsaturated zone, 15:48348 (BA;US)
International safeguards relevant to geologic disposal of high-level wastes and spent fuels, 15:48302 (BA;US)
MITT; International in-situ testing of simulated HLW forms: Preliminary analysis of SRL 165/TDS waste glass and metal systems, 15:48319 (BA;US)
Preclosure safety analysis for a prospective Yucca Mountain conceptual design repository, 15:48317 (BA;US)

Simulation of radionuclide retardation at Yucca Mountain using a stochastic mineralogical/geochemical model, 15:48308 (BA;US)
The international Stripa project: Technology transfer from cooperation in scientific and technological research on nuclear waste disposal, 15:48334 (BA;US)

Vitrification

An overview of the vitrification of defense high-level waste at the Hanford site, 15:48340 (BA;US)
Vapor hydration and subsequent leaching of transuranic-containing SRL and WV glasses, 15:48981 (BA;US)
Vitrification of defense high level radioactive waste at Savannah River and Hanford, 15:48325 (BA;US)

Waste Forms

DOE-EM/producers strategy for wasteform and process startup acceptance, 15:48326 (BA;US)
The DWPF product and its qualification program, 15:48353 (BA;US)

HIGH-TC SUPERCONDUCTORS

μ^+SR studies on $Sr_2CuO_2Cl_2$, La_2CuO_4, and Nd_2CuO_4: 2-d magnetism, local fields and muon sites, 15:48923 (R;US)
Design and testing of a high temperature superconducting current lead, 15:49205 (R;US)
Granular and superconducting-glass properties of the high-temperature superconductors, 15:48920 (R;US)
High-temperature superconductivity applications for electronic warfare and microwave systems. Final report, March 1988-March 1990, 15:49390 (R;US)
International workshop on ion beam modification and processing of high-Tc superconductors: Physics and devices: Program and abstracts, 15:48905 (R;GB)
Laser applications for high-T_c superconductors, 15:49206 (R;US)
$YBa_2Cu_3O_x$ superconductor coil: Processing and properties, 15:48914 (R;US)
[19th international conference on low-temperature physics]: Foreign trip report, August 15–25, 1990, 15:50089 (R;US)

HIGH-VOLTAGE PULSE GENERATORS

A hybrid pulse forming technique, 15:49220 (R;US)

HILACS

ECR [electron cyclotron resonance] ion sources and applications with heavy-ion linacs, 15:49240 (R;US)

HOLMIUM COMPLEXES

On the stability and bonding in bis(η-arene)lanthanide complexes, 15:49063 (RA;US)

HOLMIUM OXIDES

The upper critical field of $HoBa_2Cu_3O_{7-\delta}$ for H || c, 15:48918 (R;US)

HORIZONTAL AXIS TURBINES

Atmospheric performance of the special-purpose Solar Energy Research Institute (SERI) thin-airfoil family: Final results, 15:48484 (R;US)

HOSPITALS

Energy conservation and hospital hygiene, 15:48785 (R;FI;In Finnish)

HOT PLASMA

Possibility of using first collision probability method for solution of the problem of photon transport, 15:50125 (R;SU;In Russian)

HOT WATER HEATERS

See WATER HEATERS

HOUSES

A passive solar heating facility for existing houses: Demonstration project: Final report, 15:48473 (R;LU)
Indoor air quality in New Brunswick homes: Radon and radon daughters, 15:49464 (R;CA)
Testing of indoor radon-reduction techniques in 19 Maryland houses. Final report, January 1987-June 1989, 15:49531 (R;US)

HTGR TYPE REACTORS

See also HTTR REACTOR
A review of reactor physics uncertainties and validation requirements for the modular high-temperature gas-cooled reactor, 15:48573 (R;US)
A study on steam reforming process using nuclear heat of VHTR, 15:48576 (R;JP;In Japanese)
A vectorized heat transfer model for solid reactor cores, 15:48577 (R;US)
Bounding core temperature transients for severe and rapid water ingress scenarios in modular high temperature gas-cooled reactors, 15:48638 (R;US)
Development of THYDE-HTGR: computer code for transient thermal-hydraulics of high-temperature gas-cooled reactor, 15:48575 (R;JP)
Development of a detailed core flow analysis code for prismatic fuel reactors, 15:48572 (R;US)
HTR components irradiation tests. Actual state and future requirements, 15:48634 (RA;FR;In German)
Inherently safe characteristics of nuclear reactors, 15:48532 (R;FR)
Proceedings of the third International Atomic Energy Agency specialists' meeting on subcritical crack growth: Technical sessions 2, 3, and 4 and Recommendations and conclusions Session 5, 15:48538 (R;US)

HTO

See HEAVY WATER

HTTR REACTOR

Analysis method of fractional release of cesium from fuel elements of HTTR, 15:48630 (R;JP;In Japanese)
Behavior of radioactive organic iodide in an atmosphere of High Temperature Gas-cooled Reactor, 15:49149 (R;JP;In Japanese)
Safety demonstration test plan in the High Temperature Engineering Test Reactor (HTTR) and safety evaluation, 15:48655 (R;JP;In Japanese)

HUGENHOLTZ-PINES THEORY

See HYDROGEN

HUMAN POPULATIONS

See also A-BOMB SURVIVORS
MINORITY GROUPS
Hanford Environmental Dose Reconstruction Project: Monthly report, August 1990, 15:49546 (R;US)
Radiation protection of the public: Past, present, and future, 15:50063 (R;US)

HUMANS

See HUMAN POPULATIONS

HVAC SYSTEMS

Electric utility benefits of superconducting magnetic energy storage, 15:48497 (R;US)
State-of-the-art interior-piping-systems applications: Commercial buildings. Final report, June 1987-June 1989, 15:48792 (R;US)

HYDRAULIC CONDUCTIVITY

Predicted drainage at a semiarid site: Sensitivity to hydraulic property description and vapor flow, 15:48287 (R;US)

HYDRIDES

See also ARGON HYDRIDES
LITHIUM HYDRIDES
MOLYBDENUM HYDRIDES
THORIUM HYDRIDES
TUNGSTEN HYDRIDES
Novel measurements of nuclear spin cross-relaxation in metal hydrides, 15:50076 (R;US)
Tunable far-infrared laser spectroscopy of van der Waals bonds: Vibrational-rotation-tunneling spectra of Ar-H_2O, 15:49047 (RA;US)

HYDROCARBON FUEL CELLS

Electrocatalyst surfaces. Final report, December 1986-November 1989, 15:48762 (R;US)

HYDROCARBONS

See also ANTHRACENE
BENZENE
POLYCYCLIC AROMATIC HYDROCARBONS
PYRENE
TETRACENE
Catalytic hydrotreatment of refinery waste: Demonstration project: Final report, 15:48145 (R;LU)
Crossed molecular beams, 15:49050 (RA;US)

HYDROCHLORIC ACID
Tunable far-infrared laser spectroscopy of hydrogen bonds: The K_a = O(u) → 1 (g) rotation-tunneling spectrum of the HCl dimer, 15:49048 (RA;US)

HYDROELECTRIC POWER
Hydroelectric installations: A priceless heritage, 15:48445 (RA;CA)

HYDROELECTRIC POWER PLANTS
See also SMALL-SCALE HYDROELECTRIC POWER PLANTS
Bottom ice, in situ and long term evaluation, 15:48447 (RA;CA)
Energy reliability and the planning of power generating equipment, 15:48672 (RA;CA)
Stress-strain behavior of the LG 4 dam, 15:48451 (RA;CA)

HYDROELECTRICITY
See HYDROELECTRIC POWER

HYDROGEN
A study on steam reforming process using nuclear heat of VHTR, 15:48576 (R;JP;In Japanese)
An apparatus for studies of hydrogen isotope exchange over metals using laser-Raman spectroscopy, 15:48998 (R;US)
Determination of hydrogen (deuterium) density profiles in thin metal films and multilayers by neutron reflection, 15:48857 (R;US)
Formation and stability of As-H bonds in H-implanted GaAs, 15:49083 (R;US)
Monte Carlo study of electron correlation functions for small molecules, 15:49880 (RA;US)
NMR [nuclear magnetic resonance] studies of hydrogen in metals and hydrides at very high temperatures, 15:50074 (R;US)
Quantization with acount of barrier permeability, 15:50098 (R;SU;In Russian)
Rotational and temperature effects on Coulomb capture of muons by hydrogen molecules, 15:50190 (RA;GB)

HYDROGEN 1
Diffusion of muonic hydrogen atoms, 15:50189 (RA;GB)
Direct observation of hydrogen wave functions, 15:49878 (RA;JP)
Kinetics of the excited mesic hydrogen in the mixture of hydrogen isotopes, 15:50191 (RA;GB)

HYDROGEN 1 TARGET
Cumulative nucleon production in ^{3}Hep- and ^{3}Hp interactions at momenta of colliding nuclei 5 GeV/c, 15:49997 (R;SU;In Russian)
Polarization phenomena in reactions of deuteron stripping type, 15:50038 (R;SU)

HYDROGEN 2
See DEUTERIUM

HYDROGEN 3
See TRITIUM

HYDROGEN 4
Neutron-rich isotopes of the lightest elements, 15:49991 (R;SU)

HYDROGEN 5
Neutron-rich isotopes of the lightest elements, 15:49991 (R;SU)

HYDROGEN 6
Neutron-rich isotopes of the lightest elements, 15:49991 (R;SU)

HYDROGEN 7
Neutron-rich isotopes of the lightest elements, 15:49991 (R;SU)

HYDROGEN CHLORIDES
See HYDROCHLORIC ACID

HYDROGEN DONOR REACTIONS
See HYDROGEN TRANSFER

HYDROGEN HYDROXIDES
See WATER

HYDROGEN IONS
Dissociative recombination of molecular ions H_2^+, 15:49875 (R;SU;In Russian)
Summary of the NAPAP state of science report on deposition monitoring in North America, 1979–1987, 15:49457 (R;US)

HYDROGEN NITRATES
See NITRIC ACID

HYDROGEN SULFATES
See SULFURIC ACID

HYDROGEN SULFIDES
Adsorption and surface reactions of H_2S and SO_2 on Cu(100) studied by electron-energy-loss spectroscopy, 15:49134 (RA;US)
State-of-the-art interior-piping-systems application: On-site H_2S/O_2 removal technology. Final report, June 1988-March 1989, 15:48190 (R;US)

HYDROGEN TRANSFER
Correct short-time propagator for Feynman path integration by power-series expansion in Δt, 15:50230 (RA;US)

HYDROLASES
Synthesis of cell wall xylans and glucans by golgi membranes, 15:49649 (J;US)
The effect of denaturation and reduction on cellobiohydrolase 1 from Trichoderma reesei, 15:49642 (R;US)

HYDROLOGY
Annual report 1988 of the GSF Institute of Hydrology, 15:49594 (R;DE;In German)
Ecological characterization atlas of coastal Alabama: Map narrative, 15:49571 (R;US)
Eighth Canadian hydrotechnical conference: Proceedings, 15:48443 (R;CA)

HYDROXYBENZENE
See PHENOL

HYDROXYTOLUENES
See CRESOLS

HYPERONS
Perspectives of experimental study of electromagnetic form factors of unstable particles at UNK, 15:49911 (R;SU;In Russian)

HYSTERESIS
Mathematical models of hysteresis: Progress report, January 1990–December 1990, 15:50091 (R;US)

I

IAEA AGREEMENTS
Agreement of 2 October 1989 between the Socialist Republic of Viet Nam and the International Atomic Energy Agency for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons, 15:48390 (R;XA)
Agreement of 24 February 1989 between the Republic of Tunisia and the International Atomic Energy Agency for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons, 15:48391 (R;XA)

IAEA SAFEGUARDS
Agreement of 2 October 1989 between the Socialist Republic of Viet Nam and the International Atomic Energy Agency for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons, 15:48390 (R;XA)
Agreement of 24 February 1989 between the Republic of Tunisia and the International Atomic Energy Agency for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons, 15:48391 (R;XA)
The text of the Agreement of 12 July 1973 between Costa Rica and the Agency for the application of safeguards in connection with the Treaty for the Prohibition of Nuclear Weapons in Latin America and the Treaty on the Non-Proliferation of Nuclear Weapons, 15:48389 (R;XA)

IBM COMPUTERS
Conversational Monitor System (CMS) at Argonne National Laboratory (ANL): Revision 2, 15:50212 (R;US)
Performance evaluation of the IBM RISC [reduced instruction set computer] System/6000: Comparison of an optimized scalar processor with two vector processors, 15:50224 (R;US)

ICE
Bottom ice, in situ and long term evaluation, 15:48447 (RA;CA)
Offshore ice problems in the Arctic Sea, 15:49194 (RA;CA)

IGNALINSK-1 REACTOR
Computer operating support system of NPP main equipment, 15:48613 (RA;XA)

IGNALINSK-2 REACTOR
Computer operating support system of NPP main equipment, 15:48613 (RA;XA)

IGNEOUS ROCKS
See also VOLCANIC ROCKS
Thermal neutron absorption cross sections for igneous rocks: Newberry Caldera, Oregon, 15:48479 (R;US)

ILLINOIS
Illinois water-quality report, 1988-1989. Final report, 15:49618 (R;US)

ILLUMINATION SYSTEMS
See LIGHTING SYSTEMS

IMAGE CONVERTERS
Total emission current in one-chamber electron-optical converters, 15:49384 (R;SU;In Russian)

IMAGE INTENSIFIERS
Picosecond intensifier gating with a plated webbing cathode underlay, 15:49382 (R;US)
Sub-nanosecond intensifier gating using heavy and mesh cathode underlays, 15:49381 (R;US)

IMAGE PROCESSING
Accelerated image reconstruction for a cylindrical positron tomograph using Fourier domain methods, 15:49351 (J;US)
Characterization of a whole body imaging technique for PET, 15:49699 (J;US)
Design considerations for a single tube gamma camera, 15:49348 (J;US)
Measuring PET scanner sensitivity: Relating count rates to image signal-to-noise ratios using noise equivalent counts, 15:49350 (J;US)
The feasibility of images reconstructed with the method of sieves, 15:49702 (J;US)

IMAGE SCANNERS
A high-resolution SPECT system based on a microchannel-plate imager, 15:49346 (J;US)
A new generation of SPECT and PET systems based on position sensitive photomultipliers, 15:49363 (J;US)
Application of mathematical removal of positron range blurring in positron emission tomography, 15:49360 (J;US)
Calibration of detector sensitivity in positron cameras, 15:50064 (J;US)
Detector, shielding and geometric design factors for a high-resolution PET system, 15:49347 (J;US)
Measuring PET scanner sensitivity: Relating count rates to image signal-to-noise ratios using noise equivalent counts, 15:49350 (J;US)
Quality assurance of computed tomography scanner beams in diagnostic radiology, 15:49680 (RA;GB)
Quality control in computed tomography X-ray scanners, 15:49682 (RA;GB)
Quality control in quantitative computed tomography, 15:49681 (RA;GB)
Test of the HISPET prototype, 15:49353 (J;US)

IMMUNOGLOBULINS
Isolation and purification of rabbit imunoglobulin (IgG) for the production of a second antibody for radioimunoassay, 15:49693 (R;BR;In Portuguese)

IMPACT SHOCK
Computer modeling of 12-inch actuator shock test performance, 15:49190 (R;US)

IN-CORE FUEL MANAGEMENT
See FUEL MANAGEMENT

INCIDENTS
See ACCIDENTS

INCINERATION
See COMBUSTION

INCINERATORS
Materials of construction and corrosion history for a low-level radioactive waste incinerator, 15:48294 (B;US)
Study on feasible applications of stirling cycle machine, 15:48837 (R;JP;In Japanese)

INCLUSIVE DISTRIBUTION
See DISTRIBUTION

INCOLOY 800
Corrosion behavior of materials in FBC [fluidized-bed combustion] environments, 15:48105 (R;US)

INDIUM ARSENIDES
Electric-field dependent electroreflectance and photocurrent spectroscopy in InGaAs/InAlAs strained-layer superlattices, 15:48974 (R;US)
Ion mixing of semiconductor superlattices, 15:48951 (R;US)
Nonparabolic conduction bands and masses in strained-single-quantum wells, 15:48975 (R;US)
Photoluminescence studies of $In_xGa_{1-x}As/Al_yGa_{1-y}As$ strained-layer structures: Effects of annealing, 15:48976 (R;US)

INDIUM PHOSPHIDE SOLAR CELLS
New directions in InP solar cell research, 15:48459 (R;US)

INDIUM PHOSPHIDES
Efficient photovoltaic devices for InP semiconductor/liquid junctions. Technical report, 15:48454 (R;US)

INDOOR AIR POLLUTION
An overview of instrumentation for measuring environmental radon and radon progeny, 15:49562 (J;US)
Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 2: Final report, 15:48775 (R;CA)
Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 4: Final report, 15:48777 (R;CA)
Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 3: Final report, 15:48776 (R;CA)
Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 5: Final report, 15:48778 (R;CA)
Indoor air '90: The fifth international conference on indoor air quality and climate: Volume 1: Final report, 15:48774 (R;CA)

INDUCTORS
See SOLENOIDS

INDUSTRIAL PLANTS
See also COAL GASIFICATION PLANTS
COAL LIQUEFACTION PLANTS
COAL PREPARATION PLANTS
ETHANOL PLANTS
NATURAL GAS PROCESSING PLANTS
OIL SAND PROCESSING PLANTS
OIL SHALE PROCESSING PLANTS
PETROLEUM REFINERIES
SYNTHETIC FUELS REFINERIES
Controlling real-time systems with parallel processes, 15:50238 (R;NL)

INDUSTRIAL SECTOR
See INDUSTRY

INDUSTRIAL WASTES
Bioremediation: Innovative applications of an established technology, 15:48164 (RA;CA)

INDUSTRY
See also AGRICULTURE
CHEMICAL INDUSTRY
ELECTRIC POWER INDUSTRY
FOOD INDUSTRY
MINERAL INDUSTRY
NATURAL GAS INDUSTRY
OIL SAND INDUSTRY
PETROLEUM INDUSTRY
WOOD PRODUCTS INDUSTRY
The role of model based control in robotics, 15:50248 (J;US)

INELASTIC SCATTERING
Neutron scattering in solid state physics and materials science, 15:48625 (RA;FR)

INERTIAL CONFINEMENT
KMS Fusion Inc., 1989 semi-annual technical report, October 1988–March 1989, 15:50169 (R;US)

INFORMATION SYSTEMS
A unified framework for credit assignment, 15:50214 (R;US)
Advanced computer program (ACP) at KEK, 15:50223 (RA;JP)
International Energy: Subject Thesaurus, 15:50249 (R;US)
International english, 15:50254 (R;US)
Managing technical information in a multi-contractor environment, 15:50255 (R;US)
Report on the preparatory investigation of the Pacific energy information network system, 15:48741 (R;JP;In Japanese)

INFRARED THERMOGRAPHY
An infrared imaging area sensor for tactical and physical security applications, 15:48394 (R;US)
INHALATION EXPOSURE CHAMBERS
See EXPOSURE CHAMBERS
INHIBITORS (CORROSION)
See CORROSION INHIBITORS
INHOMOGENEOUS PLASMA
The spectra of spontaneous emission from inhomogeneous plasma half-space, 15:50151 (R;UA;In Russian)
INORGANIC COMPOUNDS
Chemical data bases for the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1, 15:49151 (R;US)
INORGANIC POLYMERS
Influence of electron withdrawing groups and molecular conformation on the nonlinear optical response of derivatized phosphazenes, 15:49085 (BA;US)
INSTRUMENTS (MEASURING)
See MEASURING INSTRUMENTS
INTEGRATED CIRCUITS
A 4096 cell switched capacitor analog waveform storage integrated circuit, 15:48686 (J;US)
A high speed, high gain preamplifier system for silicon strip detectors, 15:49340 (J;US)
A monolithically integrated detector-preamplifier on high-resistivity silicon, 15:49342 (J;US)
A versatile, programmable control and data acquisition system for complex integrated circuits, 15:49332 (J;US)
Integrating and enhancing tool for ASIC design using MOSIS fabrication, 15:49222 (J;US)
Radiation effects on the SVX silicon strip readout chip, 15:49371 (J;US)
Short and long loop manufacturing feedback using a multisensor assembly test chip, 15:49191 (R;US)
INTENSIFIERS (IMAGE)
See IMAGE INTENSIFIERS
INTERACTING BOSON MODEL
Selection of collective degrees of freedom in the boson space, 15:49964 (R;BR)
INTERACTIVE DISPLAY DEVICES
CANVAS: C++ objects for easy graphics on an Evans and Sutherland PS390 terminal: User's guide, 15:50216 (R;US)
INTERACTIVE GRAPHICS
See INTERACTIVE DISPLAY DEVICES
INTERCONNECTED POWER SYSTEMS
Energy reliability and the planning of power generating equipment, 15:48672 (RA;CA)
Optimal arrangement of hydroelectric power systems, 15:48449 (RA;CA)
INTERCRYSTALLINE CORROSION
See INTERGRANULAR CORROSION
INTERFACES
Bonding mechanisms in silicon nitride brazing, 15:48943 (J;US)
Compositional imaging of semiconductor interfaces by Z-contrast scanning transmission electron microscope (STEM), 15:48952 (R;US)
Deducing mechanical properties due to interfaces from their acoustical response, 15:48877 (R;US)
Residual stress at fluid interfaces, 15:48870 (R;US)
Stress accommodation in large-mismatch systems, 15:48979 (R;US)
Work in progress, 15:49038 (RA;US)
INTERFACES (EQUIPMENT)
See EQUIPMENT INTERFACES
INTERFERENCE
Simulation of alpha continuous air monitor alarm response in the presence of plutonium, 15:49557 (R;US)
INTERGRANULAR CORROSION
BWR [Boiling Water Reactor] Owners Group Intergranular Stress Corrosion Cracking Research Program: Executive summary: Phase 2 (1984–1988): Final report, 15:48528 (R;US)
INTERMETALLIC COMPOUNDS
The stability of irradiation-induced defects in NiAl, 15:48864 (R;US)
INTERNAL COMBUSTION ENGINES
See also DIESEL ENGINES
GAS TURBINE ENGINES
Vehicle research for future fuels, 15:48843 (RA;CA)
INTERNATIONAL ORGANIZATIONS
See also EUROPEAN COMMUNITIES
JINR
UNITED NATIONS
WHO
An overview of the International Electrotechnical Commission's activities on quality assurance in diagnostic radiology, 15:49667 (RA;GB)
INTERSTELLAR GRAINS
A coal model for the carriers of the unidentified IR bands, 15:49771 (RA;FR)
Chemistry on interstellar grains and implications for infrared spectroscopy, 15:49762 (RA;FR)
Infrared diagnostics for interstellar solid state chemistry, 15:49764 (RA;FR)
Interstellar extinction in the infrared, 15:49760 (RA;FR)
Spectropolarimetry as a diagnostic of the interstellar medium, 15:49761 (RA;FR)
Spectroscopy and physico-chemistry of CO:H_2O and CO_2:H_2O ices, 15:49772 (RA;FR)
INTERSTELLAR SPACE
A unified model for the 3.28 μ m and 3.4 μ m spectral feature in the interstellar medium and in comets, 15:49757 (RA;FR)
Infrared spectroscopy in astronomy: Proceedings of the 22 Eslab Symposium, 15:49750 (R;FR)
The unidentified IR bands in laboratory, in interstellar medium and in comets, 15:49754 (RA;FR)
Wide-beam balloon observations of the 157.7μm [CII]-line, 15:49767 (RA;FR)
INTRUSION
A Nuisance Alarm Data System for evaluation of intrusion detectors, 15:49379 (R;US)
INTRUSION DETECTION SYSTEMS
Validating detection probabilities for the ASSESS [Analytic System and Software for Evaluating Safeguards and Security] insider database, 15:48395 (R;US)
INVERTERS
Japanese power electronics inverter technology and its impact on the American air conditioning industry, 15:48793 (R;US)
IODINE
Iodine chemistry and transport calculations for the radioiodine test facility experiments (ACE-RTF) using the MITIMAKS code and the LIRIC data base, 15:49152 (R;CH)
IODINE 127 TARGET
Strength function of xenon 127 and cross section of $^{127}I(\nu_e, e^-)^{127}Xe$ reaction, 15:50028 (R;SU;In Russian)
IODINE 131
Engineering study: Improved facilities for the removal of Iodine-131 from Purex process vent off-gas, 15:48225 (R;US)
IODINE COMPOUNDS
Ultrahigh-resolution (1+1) photoionization spectroscopy of KrI: Hyperfine structures, isotope shifts, and lifetimes for the n = 5,6,7 4^5ns Rydberg levels, 15:49886 (RA;US)
IODINE IODIDES
See IODINE
ION BEAMS
See also ARGON 40 BEAMS
CARBON 12 BEAMS
DEUTERON BEAMS
Application of ion beam sputtering for diffusion study in solids, 15:50065 (R;GB)
Intense ion beam transport in neutral gas, 15:50202 (R;US)
ION COLLISIONS
See also ION-ATOM COLLISIONS
[Atomic physics with highly charged ions]: Progress report, FY 1990, 15:49873 (R;US)
ION EXCHANGE MATERIALS
Solidification in cement of ion-exchange resins from LOMI [Low Oxidation State Metal Ion] decontamination: Final report, 15:48269 (R;US)

ION EXCHANGE MEMBRANES
See ION EXCHANGE MATERIALS
MEMBRANES

ION MICROPROBE ANALYSIS
Application of ion beam sputtering for diffusion study in solids, 15:50065 (R;GB)

ION SOURCES
ECR [electron cyclotron resonance] ion sources and applications with heavy-ion linacs, 15:49240 (R;US)

ION-ATOM COLLISIONS
High-energy atomic physics, 15:49887 (RA;US)

IONIC REACTIONS
See CHEMICAL REACTIONS
IONS

IONIZATION CALORIMETERS
See SHOWER COUNTERS

IONIZATION CHAMBERS
See also LIQUID IONIZATION CHAMBERS
MULTIWIRE IONIZATION CHAMBERS
A multi-channel waveform digitizer system, 15:49338 (J;US)

IONIZING RADIATIONS
See also COSMIC RADIATION
X RADIATION
Effects of ionizing radiation on the performance of selected tactical combat crews. Technical report, 12 March 1986-30 October 1987, 15:49708 (R;US)
Health effects of ionizing radiation, 15:49715 (R;CA)

IONOSPHERE
Amplitude and phase scintillation and ionospheric irregularities at sub-auroral latitudes. Interim report, 30 September 1987-31 March 1989, 15:49855 (R;GB)
Electrodynamics of the high-latitude ionosphere. Final report, September 1986-September 1989, 15:49858 (R;US)
Neutral and ion composition changes in the F Region over Millstone Hill during the equinox transition study, 15:49856 (R;US)
Thermosphere-ionosphere coupling: An experiment in interactive modeling, 15:49850 (R;US)
Viking data analysis. Final technical report, August 1986-March 1990, 15:49853 (R;US)

IONS
See also ARGON IONS
CERIUM IONS
EUROPIUM IONS
HEAVY IONS
HYDROGEN IONS
IRON IONS
LUTETIUM IONS
MULTICHARGED IONS
PLUTONIUM IONS
URANIUM IONS
Application range of the impulse approximation at calculation of ion transport in matter, 15:50058 (RA;SU;In Russian)
Work in progress, 15:49890 (RA;US)

IOWA
Health assessment for Union Carbide Disposal/Red Oak Landfill Site, Red Oak, Iowa, Region 7. CERCLIS No. IAD980643509. Preliminary report, 15:49539 (R;US)

IRIDIUM 192
Radioisotopes production programmes for reactor radioisotopes, 15:48636 (RA;FR)

IRIDIUM COMPLEXES
C-H insertion and π-complex formation reactions of $(\eta^5\text{-}C_5Me_5)(PMe_3)Ir$ with ethylene: An intra- and intermolecular isotope-effect study, 15:49056 (RA;US)
Synthesis of an $(\eta^3$-allyl)(hydrido)iridium complex and its reactions with arenes and alkanes. Sequential intermolecular C-H oxidative addition and hydride-to-alkene migratory insertion reactions, 15:49002 (RA;US)

IRIDIUM COMPOUNDS
The thermodynamic driving force for C-H activation at iridium, 15:49057 (RA;US)
Transition metal-catalyzed conversion of CO, NO, H_2, and organic molecules to fuels and petrochemicals, 15:49001 (RA;US)

IRON
Consistency of microscopic evaluations and integral experiments for chromium, iron and nickel, 15:50009 (R;XA)
Improved Fischer-Tropsch Synthesis catalysts for indirect coal liquefaction: ' Quarterly technical progress report No. 8, 1 July–30 September 1987, 15:48075 (R;US)
Investigations of defined oxides for improving the determination of emissivity of high temperatures. Pt. 1 and 2. Pt. 1: Determination of emissivity and optical constants. - Pt. 2: Preparation and analysis of probes, 15:48874 (R;DE;In German)
Magnetic properties of ultrathin epitaxial films of iron, 15:48861 (R;US)
The neutron leakage spectrum for an iron sphere with a central 14 MeV neutron source, 15:50056 (R;XA)
Wear-metal analysis in engine oil by microwave digestion and atomic absorption spectroscopy. Final report, August 1987-January 1988, 15:48988 (R;US)

IRON 54
Neutron-proton ratios of collective quadrupole matrix elements in even Fe and Cr isotopes, 15:50040 (R;SU)

IRON 55
Determination of iron 55 in nuclear wastes and effluents, 15:48991 (R;FR;In French)

IRON 56
Microscopic description of neutron and proton transition moments in spherical nuclei, 15:50037 (RA;SU)
Neutron-proton ratios of collective quadrupole matrix elements in even Fe and Cr isotopes, 15:50040 (R;SU)

IRON 56 TARGET
Detection and experimental investigation of α-particle Wolf-Bragg scattering on quasicrystalline atomic nuclei, 15:49990 (R;SU;In Russian)

IRON 58
Neutron-proton ratios of collective quadrupole matrix elements in even Fe and Cr isotopes, 15:50040 (R;SU)

IRON ALLOYS
See also IRON BASE ALLOYS
Corrosion fatigue crack propagation in metals, 15:48893 (R;US)
Preliminary model of repository chemistry for the Waste Isolation Pilot Plant, 15:48288 (R;US)
Surface phases and their influence on metal-oxide interfaces: [Progress report], 15:48869 (R;US)

IRON BASE ALLOYS
See also ALLOY-FE44NI33CR21
CAST IRON
STEELS
Investigations of defined oxides for improving the determination of emissivity of high temperatures. Pt. 1 and 2. Pt. 1: Determination of emissivity and optical constants. - Pt. 2: Preparation and analysis of probes, 15:48874 (R;DE;In German)
The interaction of point defects with line dislocations in HVEM [high voltage electron microscope] irradiated Fe-Ni-Cr alloys, 15:48862 (R;US)

IRON COMPOUNDS
See also FERRITES
IRON SULFIDES
Ionic atmosphere effects on the energetics of thermal and optical electron-exchange reactions: Application to ferrocenium-ferrocene self exchange. Technical report, 15:49031 (R;US)
Theoretical study of the interaction of Fe, Fe^+, and FeCO with Ar, 15:49046 (RA;US)

IRON IONS
The chemical state of iron ions implanted into silicon carbide, 15:48950 (R;US)

IRON SULFIDES
See also PYRITE
Electronic structure, hyperfine interactions, and magnetic properties for iron octahedral sulfides, 15:49881 (RA;US)

IRON-AIR BATTERIES
Analysis and simulation of electrochemical systems, 15:49115 (RA;US)

IRRIGATION
Irrigation pumping plant evaluation: Interim report, 15:48820 (R;CA)

ISOBARS (NUCLEON)
See N*BARYONS
ISOMERIC NUCLEI
Shape isomers at no spin, 15:50013 (R;FR)
ISOTOPE ENRICHMENT
See ISOTOPE SEPARATION
ISOTOPE SEPARATION
See also GAS CENTRIFUGATION
GASEOUS DIFFUSION PROCESS
LASER ISOTOPE SEPARATION
Compared economic features of enrichment processes, 15:48249 (RA;XA)
Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988, 15:48242 (R;XA)
Third isotope separation workshop, 15:48400 (R;CA)
ISOTOPES
See also FISSION PRODUCTS
GOLD ISOTOPES
MERCURY ISOTOPES
OSMIUM ISOTOPES
OXYGEN ISOTOPES
PLATINUM ISOTOPES
RADIOISOTOPES
RADON ISOTOPES
Isotope geochemistry: A critical component of energy research, 15:49739 (R;US)
ISOTOPIC SEPARATION
See ISOTOPE SEPARATION
ITER TOKAMAK
Prestudy of burn control in NET: Second intermediate report, February 1990, 15:50113 (R;SE)

J

JAERI TANDEM ACCELERATOR
Report of the seminar on nuclear physics and atomic physics at the JAERI tandem-booster accelerator, 15:49259 (R;JP)
JAILS
See PUBLIC BUILDINGS
JAPAN RESEARCH REACTOR-3
See JRR-3 REACTOR
JAPANESE ORGANIZATIONS
Annual report of National Institute of Radiological Sciences of the fiscal year 1987, 15:50206 (R;JP;In Japanese)
JET ENGINE FUELS
Fuel-rich catalytic combustion: A fuel processor for high-speed propulsion, 15:49156 (R;US)
Three-dimensional fluid flow in JFTOT [Jet Fuel Thermal Oxidation Tester], 15:49154 (R;US)
JETS
Adaptation of high pressure water jets with abrasives for nuclear installations dismantling, 15:48651 (R;FR;In French)
JINR
JINR rapid communications: Collection, 15:49745 (R;SU;In Russian)
JINR SYNCHROTRON
JINR synchrophasotron: Operation and improvement (quarters 1,2,1988), 15:49229 (R;SU;In Russian)
JOINT INSTITUTE FOR NUCLEAR RESEARCH
See JINR
JOULE HEATING
Supersonic jets of cylindrical metallic plasma shells as imploding loads in high-power dense Z-pinch, 15:50111 (R;FR)
JPFR REACTOR
See MONJU REACTOR
JRR-3 REACTOR
Present status of heat transfer in narrow gap rectangular channel, 15:49185 (RA;JP;In Japanese)
The design and construction of the neutron guide tubes in JRR-3, 15:48631 (R;JP;In Japanese)
JT-60 REACTORS
See JT-60 TOKAMAK
JT-60 TOKAMAK
Density limit in JT-60, 15:50156 (R;JP)
Review of JT-60 experimental results from January to October, 1989, 15:50155 (R;JP)
JUNCTIONS (SEMICONDUCTOR)
See SEMICONDUCTOR JUNCTIONS

K

K CODES
Software for the ODRA and ODRENOK computers; programs for text file processing, 15:50220 (R;SU;In Russian)
K*RESONANCES
See STRANGE MESONS
K-1240 RESONANCES
See STRANGE MESONS
K-1871 RESONANCES
See STRANGE MESONS
K02
See KAONS NEUTRAL LONG-LIVED
KALKAR POWER REACTOR
See SNR REACTOR
KAOLINITE
Mechanisms of surface enrichment and adhesion of coal combustion particulates: Eighth and ninth quarterly reports, June 16, 1988–December 15, 1988, 15:48113 (R;US)
Mechanisms of surface enrichment and adhesion of coal combustion particulates: Sixth and seventh quarterly reports, December 16, 1987–June 15, 1988, 15:48112 (R;US)
KAONS 2
See KAONS NEUTRAL LONG-LIVED
KAONS MINUS
Cumulative K^--meson production by protons with energy of 10 GeV, 15:49988 (R;SU;In Russian)
K^--meson production in relativistic nuclear collisions and nuclear pionization model, 15:50044 (RA;SU;In Russian)
KAONS NEUTRAL
See also KAONS NEUTRAL LONG-LIVED
Supersymmetric version of horizontal gauge interactions, 15:49931 (R;SU)
KAONS NEUTRAL LONG-LIVED
Decays of η- and K_L-mesons into a lepton pair: three-dimensional theory and phenomenology, 15:49951 (R;SU;In Russian)
KAONS PLUS
On the strange particle production in the nuclear pionization model, 15:50043 (R;SU;In Russian)
KAPPA-725 RESONANCES
See MESONS
KEK PHOTON FACTORY
Photon Factory activity report, 1989, 15:50203 (R;JP)
KENTUCKY
Health assessment for Tri-City Industrial Disposal Site, Brooks, Kentucky, Region 4. CERCLIS No. KYD981028350. Preliminary report, 15:49619 (R;US)
KETENES
Rate constants for $^3CH_2$ (X^3B_1) removal by O_2, NO, and C_2H_2 from infrared-diode laser flash kinetic spectroscopy, 15:49039 (RA;US)
KEVLAR
See ARAMIDS
KILNS
Insulation cuts curing costs, offers better kiln control, 15:48817 (R;CA)
Sealing and insulating specific areas of bulk tobacco kilns: Final report, 15:48812 (R;CA)
Versatility of tobacco kilns eases shift to alternate crops, 15:48818 (R;CA)
KINETICS EQUATIONS (REACTOR)
See REACTOR KINETICS EQUATIONS
KNOCK-ON ELECTRONS
See ELECTRONS
KOBAYASHI-MASKAWA MATRIX
Measurement of V_{ub}, 15:49913 (RA;JP;In Japanese)

KRYPTON 84 REACTIONS
Central collisions at the fermi energy, 15:50012 (R;FR)
KRYPTON 85
Krypton-85 concentration in the atmosphere, 15:49460 (RA;DE;In German)
KRYPTON COMPOUNDS
Ultrahigh-resolution (1+1) photoionization spectroscopy of KrI: Hyperfine structures, isotope shifts, and lifetimes for the n = 5,6,7 4^5ns Rydberg levels, 15:49886 (RA;US)
KRYPTONATES
See KRYPTON COMPOUNDS
KUWAIT
Kuwait Petroleum Corporation: New horizons for national oil companies, 15:48140 (RA;CA)

L

L CODES
Software for the ODRA and ODRENOK computers; programs for text file processing, 15:50220 (R;SU;In Russian)
L REACTOR
Simulation of three-dimensional hydrodynamic components with a one-dimensional transient analysis code, 15:48659 (R;US)
L-1770 RESONANCES
See STRANGE MESONS
LA REINA REACTOR
See RESEARCH REACTORS
LAGUNA VERDE-1 REACTOR
Economics of the use of the Laguna Verde 2 initial core as reloads of Laguna Verde 1, 15:48248 (RA;XA)
LAKES
Atikokan TGS aquatic studies, 1981 to 1988, II: Water chemistry, 15:48516 (R;CA)
Modeled sulfur deposition trends since 1990 in North America, 15:49456 (R;US)
LAMBDA NEUTRAL
See LAMBDA PARTICLES
LAMBDA PARTICLES
See also ANTILAMBDA PARTICLES
Analysis of the reaction p-barp→Λ-barΛ near the threshold, 15:49940 (R;SU)
LAND FILLS
See SANITARY LANDFILLS
LAND RECLAMATION
Alberta reclamation research annual report, 1987, 15:48734 (R;CA)
Proceedings of the conference Reclamation, a global perspective: Volume 1, 15:49413 (R;CA)
Proceedings of the conference Reclamation, a global perspective: Volume 2, 15:49414 (R;CA)
LANDFILLS
See SANITARY LANDFILLS
LANGMUIR OSCILLATIONS
See PLASMA WAVES
LANGUAGES (PROGRAMMING)
See PROGRAMMING LANGUAGES
LANL
Isotope geochemistry: A critical component of energy research, 15:49739 (R;US)
LANTHANUM 138
Applications of diode lasers to resonance ionization mass spectrometry, 15:49870 (R;US)
LANTHANUM 139
Applications of diode lasers to resonance ionization mass spectrometry, 15:49870 (R;US)
LANTHANUM CHROMITES
See CHROMIUM OXIDES
LANTHANUM OXIDES
LANTHANUM COMPLEXES
On the stability and bonding in bis(η-arene)lanthanide complexes, 15:49063 (RA;US)
LANTHANUM OXIDES
Excess oxygen defects in layered cuprates, 15:48913 (R;US)
Magnetic properties of Hubbard-sigma model with three-dimensionality, 15:48917 (R;JP)
On the electronic structure of high temperature superconductors: Nonalloyed CuOsub 2 plane, 15:50077 (R;SU;In Russian)
LANTHANUM SULFIDES
A study of the thermoelectric properties of Ca, Sr and Hg substituted lanthanum sulfides, 15:48956 (R;US)
LASER CAVITIES
Limits imposed by spatial hole burning on the single-mode operation of standing-wave laser cavities, 15:49202 (R;US)
LASER ISOTOPE SEPARATION
Method of measuring CF_3T activity developed for laser-based tritium separation, 15:48399 (R;CA)
LASER SPECTROSCOPY
See also RAMAN SPECTROSCOPY
Gas laser spectrometer for nuclear investigation at nucleonic stability limit. (project), 15:49308 (R;SU;In Russian)
LASER-PRODUCED PLASMA
Laser spectroscopy in a laser-produced plasma at atmospheric pressure: comparison between A.E.S., L.I.F., and L.E.I./R.I.S. for the analysis of solid samples, 15:48990 (R;FR)
Study on the atom beams and plasma production at the materials evaporation by laser radiation, 15:50158 (R;UA;In Russian)
LASERS
See also FREE ELECTRON LASERS
Limits imposed by spatial hole burning on the single-mode operation of standing-wave laser cavities, 15:49202 (R;US)
Trip report: International Congress on Applications of Lasers and Electro-Optics, Oct. 16-19, 1989, Orlando, Florida, 15:48895 (R;CA)
LATTICE FIELD THEORY
Notes on some algebraic structures common to integrable lattice systems and conformal field theories, 15:49963 (R;FR)
LATTICES (CRYSTAL)
See CRYSTAL LATTICES
LAWRENCE BERKELEY LABORATORY
Isotope geochemistry: A critical component of energy research, 15:49739 (R;US)
LAWRENCE LIVERMORE LABORATORY
Public attitudes toward Lawrence Livermore National Laboratory: Summary of findings, 15:48701 (R;US)
LEACHATES
Characterization of leachate produced from sulphur-contaminated soils, 15:48183 (RA;CA)
LEAD
Calculation of energy release depth distributions for electrons with 5-100 MeV energy in thick targets, 15:50057 (RA;SU;In Russian)
Cross section and analyzing power for quasifree (p,n) reactions, 15:50000 (R;US)
Final best demonstrated available technology (BDAT) background document for D008 and P and U lead wastes. Volume 23, 15:49497 (R;US)
Final best demonstrated available technology (BDAT) background document for K046 (Addendum). Volume 10, 15:49484 (R;US)
Final response to BDAT related comments document: D008: Characteristic wastes for lead and P and U wastes containing lead. Volume 1-H, 15:49523 (R;US)
Final treatment standards for nonwaste-water and waste-water forms of K100. Volume 12. Memorandum report, 15:49486 (R;US)
Health assessment for Abex Corporation, Portsmouth, Elizabeth County, Virginia, Region 3. CERCLIS No. VAD980551683. Preliminary report, 15:49582 (R;US)
In situ scanning tunneling microscopy of Pb multilayer deposits on Ag, 15:48695 (RA;US)
Wear-metal analysis in engine oil by microwave digestion and atomic absorption spectroscopy. Final report, August 1987-January 1988, 15:48988 (R;US)
LEAD 207 TARGET
Search for strangeness-abundant quark-gluon matter in nucleus-nucleus and antiproton-nucleus interactions, 15:50042 (R;SU;In Russian)

LEAD BASE ALLOYS
Joint research centre fusion materials irradiations in HFR: Present status and prospectives, 15:50173 (RA;FR)

LEAD CARBONATES
Lead carbonate: A new fast, heavy scintillator, 15:49321 (J;US)

LEAD-ACID BATTERIES
A microprocessor based charge control system for the simultaneous charging of several batteries with one charge controller: Final report for 1989, 15:48839 (R;US)
Waste-minimization opportunity assessment, Fort Riley, Kansas. Summary report, April 1989-December 1989, 15:49613 (R;US)

LEAKAGE (NEUTRON)
See NEUTRON LEAKAGE

LEP STORAGE RINGS
ARTEMIS: A VMS based FASTBUS module testing and evaluation system, 15:49281 (J;US)
Experience in construction and testing of plastic limited streamer chambers, 15:49331 (J;US)

LEPTON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET

LEPTONIC DECAY
Decays of η- and K_L-mesons into a lepton pair: three-dimensional theory and phenomenology, 15:49951 (R;SU;In Russian)

LEPTONS
See also ELECTRONS
MUONS
NEUTRINOS
[Cross sections for lepton pair production and for capture of the pair-produced electrons to bound states of the fully-stripped projectiles]: Foreign trip report, July 18, 1990–August 31, 1990, 15:49917 (R;US)

LEUKEMOGENESIS
Correlation of chromosome patterns in leukemic cells of patients with exposure to chemicals and/or radiation: Progress report, January 1–August 20, 1990, 15:49655 (R;US)

LEVEL DENSITY
See ENERGY LEVELS

LEVEL SCHEMES
See ENERGY LEVELS

LIGHT NUCLEI
See also ARGON 31
BERYLLIUM 13
BERYLLIUM 6
BERYLLIUM 7
BORON 10
CARBON 14
DEUTERIUM
HELIUM 3
HELIUM 7
HELIUM 9
HYDROGEN 1
HYDROGEN 4
HYDROGEN 5
HYDROGEN 6
HYDROGEN 7
LITHIUM 10
OXYGEN 22
TRITIUM
Cross sections of scattering of ^{3}He ions and α-particles with 12-20 MeV/nucleon energy on the light nuclei, 15:49989 (R;SU;In Russian)
Experiments on neutron-rich light nuclei at Ganil, 15:49995 (R;FR)

LIGHTING SYSTEMS
Comparison of ELCAP data with lighting and equipment load levels and profiles assumed in regional models, 15:48794 (R;US)
Energy efficient lighting options, 15:48790 (R;CA)
Program experience and its regulatory implications: A case study of utility lighting efficiency programs, 15:48784 (R;US)
The optical parametrization of an aerial multispectral camera, 15:49599 (R;FI)

LINACS
See LINEAR ACCELERATORS

LINE WIDTHS
Large collective lamb shifts in high pressure noble gases, 15:49871 (R;US)

LINEAR ACCELERATORS
See also HILACS
STANFORD LINEAR COLLIDER
Floquet functions in accelerating-focusing channel with an arbitrary structure of a period, 15:49233 (R;SU;In Russian)
Operational status of the Brookhaven National Laboratory Accelerator Test Facility, 15:49225 (R;US)
Sparking limit of the accelerating gap of the heavy ion accelerator, 15:49258 (R;SU)
The BNL 200 MeV H^- linac: Performance and upgrades, 15:49239 (R;US)

LINEAR MOMENTUM TRANSFER
Study of the linear momentum transfer distribution in the ^{40} Ar + ^{12}C system at 27, 32, 36, 40, 44 and 60 MeV/A, 15:49998 (R;FR;In French)

LINEAR Z PINCH DEVICES
Supersonic jets of cylindrical metallic plasma shells as imploding loads in high-power dense Z-pinch, 15:50111 (R;FR)

LIQUEFIED NATURAL GAS
Study on feasible applications of stirling cycle machine, 15:48837 (R;JP;In Japanese)

LIQUEFIED PETROLEUM GASES
Upgrading Fischer-Tropsch naphtha, 15:48078 (R;US)

LIQUID ASPHALT
See PETROLEUM RESIDUES

LIQUID EFFLUENTS
See LIQUID WASTES

LIQUID FUELS
See also GASOLINE
Impact of renewable derived fuels on energy and agriculture sectors: Final report, 15:48411 (R;LU)
The combustion of liquid fuels, 15:48176 (R;GB)

LIQUID IONIZATION CHAMBERS
Effects of radiation damage to ionization chamber liquids, 15:49372 (J;US)

LIQUID METAL TEST FACILITIES
See TEST FACILITIES

LIQUID SCINTILLATORS
Preliminary study of radiation damage in liquid scintillators, 15:49369 (J;US)

LIQUID WASTES
See also WASTE WATER
Liquid effluent study project plan: Environmental and waste management: Revision 2, 15:48293 (R;US)

LIQUID-PHASE SINTERING
See SINTERING

LIQUIDS
Correlation of liquid-liquid equilibria for some water-organic liquid systems in the region 20-250°C, 15:49071 (RA;US)
Fundamental studies of bond breaking and forming on ultrafast timescales, 15:49036 (RA;US)
Studies of chemical reactivity in condensed phase, 15:49037 (RA;US)
Work in progress, 15:49045 (RA;US)

LITHIUM
Monte Carlo study of electron correlation functions for small molecules, 15:49880 (RA;US)

LITHIUM 10
Neutron-rich isotopes of the lightest elements, 15:49991 (R;SU)

LITHIUM ALLOYS
Corrosion protection of metal-matrix composites. Final report, October 1986-April 1990, 15:48855 (R;US)

LITHIUM FLUORIDES
Stress versus temperature dependent activation energies in creep, 15:48852 (R;US)

LITHIUM HYDRIDES
Monte Carlo study of electron correlation functions for small molecules, 15:49880 (RA;US)

LITHIUM SILICATES
Luminescence study of spodumene, 15:50071 (R;BR)

LITHIUM-SULFUR BATTERIES
Analysis and simulation of electrochemical systems, 15:49115 (RA;US)
Modeling and optimization of Li-alloy/metal-sulfide molten-salt batteries, 15:49117 (RA;US)

LMFBR TYPE REACTORS
See also EBR-2 REACTOR
SNR REACTOR
A suite of codes for the nuclear power plant design safety analysis, 15:48582 (RA;XA)
An appreciation of the events, models and data used for LMFBR radiological source term estimations, 15:48650 (R;FR)
Development of remote disassembly technology for liquid-metal reactor (LMR) fuel, 15:48579 (R;US)
Fast reactor safety testing in Transient Reactor Test (TREAT) in the 1980s, 15:48640 (R;US)
Flaw assessment procedure for high temperature reactor components, 15:48580 (R;US)
Irradiation program of the transuranium European institute in the HFR reactor, 15:48633 (RA;FR;In French)
SWAAM-code development and verification and application to steam generator designs, 15:48581 (R;US)
The search for advanced remote technology in fast reactor reprocessing, 15:48224 (R;US)
Thermal-hydraulic impact of failure of highly irradiated fuel pins on LMR passive safety, 15:48641 (R;US)

LNG
See LIQUEFIED NATURAL GAS

LOADING MACHINES (REACTOR)
See REACTOR CHARGING MACHINES

LOCA
See LOSS OF COOLANT

LOCAL BOILING
See SUBCOOLED BOILING

LOCAL GALAXY
See MILKY WAY

LOCAL GROUP
See GALAXIES

LONGITUDINAL PINCH
Kinetic limitations on sausage compression of Z-pinches, 15:50122 (R;SU;In Russian)
Maximum compression of Z-pinch in a gas with high atomic number, 15:50150 (R;SU;In Russian)
Nonlinear development of two-dimensional axial-symmetric MGD instability in a Z-pinch, 15:50123 (R;SU;In Russian)

LONGITUDINAL PINCH DEVICES (LINEAR)
See LINEAR Z PINCH DEVICES

LOS ALAMOS NATIONAL LABORATORY
See LANL

LOSS OF COOLANT
An intermediate break BWR LOCA test (RUN 991) at ROSA-III: Simulation of ECCS line break LOCA phenomena, 15:48656 (R;JP)
Analysis of bypass lines efficiency in WWER-440, 15:48555 (RA;XA)
Analysis of loop asymmetry in Paks nuclear power plant in the event of a cold leg break, 15:48557 (RA;XA)
Comparison of PMK-NVH experimental results in the event of 7.4% cold and hot leg breaks, 15:48548 (RA;XA)
Dispositions taken in France to limit gaseous releases from PWR power plants in abnormal operating conditions, 15:48540 (R;FR)
Experience of participants from the German Democratic Republic in DBA analysis for WWERs in the framework of the IAEA regional programme RER/9/004, 15:48546 (RA;XA)
Important conclusions from intermediate cold leg LOCA analysis of WWER 440 with RELAP4/MOD6 and SLAP, 15:48559 (RA;XA)
Licensing analysis of steam generator tube plugging: Influence on LB-LOCA, 15:48558 (RA;XA)
Post-test analysis of SPE-2 with TRAC-PF1, 15:48550 (RA;XA)
Post-test calculation of SPE-2 with RELAP5/MOD2, 15:48549 (RA;XA)
Thermohydraulic analysis for supporting PSA of SB LOCA in WWER-440, 15:48551 (RA;XA)
Wind force measurement on a model fuelling-machine trolley in a simulated LOCA, 15:48661 (R;CA)

LOW TEMPERATURE
Power generation using a low power Organic Rankine Cycle, 15:48492 (R;FI;In Finnish)

LOW-LEVEL RADIOACTIVE WASTES
Hanford Site radioactive solid waste acceptance criteria, 15:48292 (R;US)
Materials of construction and corrosion history for a low-level radioactive waste incinerator, 15:48294 (B;US)
Waste management aspects of the Formerly Utilized Sites Remedial Action Program, 15:48258 (R;US)

LOWER HYBRID CURRENT DRIVE
Results of preliminary theoretical investigations of the lower hybrid current drive in the T-15 tokamak, 15:50147 (RA;CS;In Russian)

LP-GAS
See LIQUEFIED PETROLEUM GASES

LR-0 REACTOR
Rod drop in the LR-0 reactor core comprising 55 fuel assemblies: A comparison of theoretical and experimental data, 15:48599 (R;CS;In Russian)

LUBRICANTS
See also LUBRICATING OILS
Injector and valve train friction studies: Cummins L-10 engine: Progress report, October 1, 1988–December 31, 1989, 15:48836 (R;US)

LUBRICATING OILS
Wear-metal analysis in engine oil by microwave digestion and atomic absorption spectroscopy. Final report, August 1987-January 1988, 15:48988 (R;US)

LUMBER INDUSTRY
See WOOD PRODUCTS INDUSTRY

LUMINESCENCE
Light-heavy-hole-mixing-induced selection rules for magneto-luminescence and valence-band energy dispersion in semiconductor quantum wells, 15:49892 (R;US)

LUNGS
Influence of experimental pulmonary emphysema on toxicological effects from inhaled nitrogen dioxide and diesel exhaust. Research report, January 1984-September 1987, 15:49721 (R;US)
X-ray spectrometry in vivo a Si(Li)-NaI(T1) detector, 15:49352 (J;US)

LUTETIUM COMPLEXES
On the stability and bonding in bis(η-arene)lanthanide complexes, 15:49063 (RA;US)

LUTETIUM IONS
Complexation of lanthanide(III) ions by catechol and similar ligands, 15:49059 (RA;US)

LUXEMBOURG
Communications received from Members regarding the export of nuclear material and of certain categories of equipment and other material: A further communication dated 9 May 1990, 15:48397 (R;XA)
Communications received from Members regarding the export of nuclear material and of certain categories of equipment and other material: A further communication dated 8 May 1990, 15:48396 (R;XA)

LWGR TYPE REACTORS
See also CHERNOBYLSK-4 REACTOR
IGNALINSK-1 REACTOR
IGNALINSK-2 REACTOR
N-REACTOR
Large nuclear reactor transient simulation, 15:48574 (RA;XA)

M

MA 754
See NICKEL BASE ALLOYS

MA 956
See IRON BASE ALLOYS
MACHINE PARTS
IGES efficiency evaluation, 15:50244 (R;US)
MAGELLANIC CLOUDS
The Magellanic clouds, 15:49834 (RA;ZA)
MAGMA
The dynamics of magma transport and eruption processes: An overview of recent developments, 15:49743 (R;US)
MAGMAMAX PROCESS
See BINARY-FLUID SYSTEMS
MAGNESIUM ALLOYS
Metal-matrix composites - a promising alternative to conventional alloys, 15:48908 (R;DE)
MAGNESIUM OXIDES
Spatially resolved Raman spectroscopy in the study of transformed zones in PSZ, 15:49077 (RA;US)
TEM characterization of nanocrystals produced by decomposition reactions, 15:48929 (RA;US)
MAGNETIC BAYS
Pi 2 pulsations and the substorm current wedge: Low-latitude polarization, 15:49857 (R;US)
MAGNETIC BREMSSTRAHLUNG
See SYNCHROTRON RADIATION
MAGNETIC FIELDS
A data acquisition system for residential magnetic field source characterization, 15:48453 (R;CA)
Characterization of field errors of layer wound short solenoids, 15:49266 (R;US)
Electric and magnetic fields and your health: A report of the Working Group on Electric and Magnetic ELP Fields, 15:49727 (R;CA)
Exposure system for animal studies involving high-level 60-Hz magnetic fields, 15:49729 (R;CA)
On the origin of cosmological magnetic fields, 15:49749 (R;US)
MAGNETIC MONOPOLES
Observation of the Dirac magnetic charges by virtue of a diffusion chamber, 15:49909 (R;SU)
MAGNETIC STORMS
Conditional climatology of Ap: The relationship between solar flares and geomagnetic storms, 15:49851 (R;US)
MAGNETOHYDRODYNAMICS
MHD Technology Transfer, Integration and Review Committee: Third semi-annual status report, April–September 1989, 15:48758 (R;US)
MAGNETOMETERS
Digital Hall magnetometer, 15:49383 (R;SU;In Russian)
Superconductor imaging surface magnetometry: Principles and applications, 15:49385 (R;US)
MAGNETOSPHERE
See EARTH MAGNETOSPHERE
MAGNETOTAIL
High energy particle experiment for the GEOTAIL mission: GEOTAIL HEP, 15:49811 (R;JP)
MAGNETOTELLURIC SURVEYS
New approaches to estimation of magnetotelluric parameters: Annual report, 1 August 1989–31 July 1990, 15:49732 (R;US)
Two and three dimensional magnetotelluric inversion: Annual progress report, 15:49733 (R;US)
MAIZE
Reduce grain drying costs by recovering lost heat, 15:48813 (R;CA)
MAMMARY GLANDS
Results and hazards of postoperative radiotherapy using orthovoltage (300 kV) in carcinomas of the breast, 15:49690 (R;DE;In German)
MAN-MACHINE SYSTEMS
Upgrading user interfaces to computational chemistry codes, 15:48987 (R;US)
MANGANESE SILICATES
Spin dynamics of the itinerant helimagnet MnSi studied by positive muon spin relaxation, 15:50029 (R;JP)
MANHATTAN PROJECT
The Manhattan Project: Science in the Second World War, 15:49397 (R;US)
MANIPULATORS
A method of using the inverse matrix for manipulator kinematics, 15:49162 (R;JP;In Japanese)
Improved tracking for bilateral teleoperators with time delay, 15:49166 (R;US)
MANITOBA
Atikokan TGS aquatic studies, 1981 to 1988, II: Water chemistry, 15:48516 (R;CA)
Canadian experience with renewable fuels, 15:48439 (RA;CA)
Manitoba Hydro application for an order requesting a general rate review and approval of certain rate adjustments effective April 1, 1990, 15:48753 (R;CA)
Recycling: What you had to say. A summary of your comments at the open houses, 15:48830 (R;CA)
The [Manitoba] Public Utilities Board annual report, 1988, 15:48181 (R;CA)
MANUFACTURERS
Implementation of a QML (Qualified Manufacturer's List) methodology for discrete semiconductors, 15:48977 (R;US)
MANUFACTURING FACILITIES
See INDUSTRIAL PLANTS
MARINE ECOSYSTEMS
See AQUATIC ECOSYSTEMS
MARINE VEHICLE ACCIDENTS
See ACCIDENTS
MARS PLANET
Discussion paper on environmental hazards on the Moon, in low Earth orbit, and in low Mars orbit, 15:49817 (R;US)
Geometrical and dynamical characteristics of the Earth, the Moon and Terrestrial planets. Part 1: 1.Topographic surfaces and Gravitational fields, 15:49812 (R;UA;In Russian)
Near infrared spectroscopy of Mars: study of the surface mineralogy, 15:49756 (RA;FR)
Observations of CO on Mars in the infrared and millimetre range, 15:49755 (RA;FR)
MARYLAND
Environmental review of Potomac Electric Power Company's proposed Station H Element I, 15:48155 (R;US)
Testing of indoor radon-reduction techniques in 19 Maryland houses. Final report, January 1987-June 1989, 15:49531 (R;US)
MASKS
See RESPIRATORS
MASS SPECTRA
More sum rules for quark and lepton masses, 15:49939 (R;JP)
MASS SPECTROMETERS
Circulation ring and mass screening of unstable nucleus, 15:49280 (RA;JP;In Japanese)
MASS SPECTROSCOPY
See also RESONANCE IONIZATION MASS SPECTROSCOPY
Calibration of the ^{14}C timescale over the past 30,000 years using mass spectrometric U-Th ages from Barbados corals, 15:49029 (J;GB)
MASS TRANSFER
See also CONVECTION
ENVIRONMENTAL TRANSPORT
Proceedings of the seminar of young scientists HEPI AN Kaz SSR. Part 2: 2. Solid state physics and mass transfer simulation, 15:50080 (R;SU;In Russian)
The dynamics of magma transport and eruption processes: An overview of recent developments, 15:49743 (R;US)
MASSACHUSETTS
Superfund Record of Decision (EPA Region 1): New Bedford, MA. (First remedial action), March 1990, 15:49628 (R;US)
MATERIALS
See also BIOLOGICAL MATERIALS
BUILDING MATERIALS
COMPOSITE MATERIALS
DIELECTRIC MATERIALS
HAZARDOUS MATERIALS

ION EXCHANGE MATERIALS
MATRIX MATERIALS
PHOTOCHROMIC MATERIALS
RADIOACTIVE MATERIALS
REACTOR MATERIALS
REINFORCED MATERIALS
SEMICONDUCTOR MATERIALS
TOXIC MATERIALS
A new method for surface structure using a combination of second harmonic generation and coverage-dependence fluorescence, 15:49035 (RA;US)
Accurate representations of general textures by a set of weighted grains, 15:48887 (R;US)
High-energy oxidizers and delocalized-electron solids, 15:49097 (RA;US)
Irradiation-enhanced and-induced mass transport, 15:48900 (J;US)
Multiple-energy techniques in industrial computerized tomography, 15:49318 (R;US)
National Educators' workshop: Update 1989 standard experiments in engineering materials science and technology, 15:48853 (R;US)
Novel materials from nanocrystalline aggregates, 15:48888 (RA;US)
Novel properties of matter at megabars of pressure, 15:50086 (RA;US)
Photoelectron spectroscopy, 15:49130 (RA;US)
Physical chemistry with emphasis on thermodynamic properties, 15:49129 (RA;US)
Studies of materials erosion in coal conversion and utilization systems, 15:48117 (RA;US)
The effect of defect clusters formed in cascades on the sink strength in irradiated materials, 15:48863 (R;US)
The use of heteroepitaxy in the fabrication of bicrystals for the study of grain-boundary structure, 15:49080 (RA;US)
Transient infrared emission spectroscopy, 15:48996 (R;US)

MATERIALS (ANTIFERROMAGNETIC)
See ANTIFERROMAGNETIC MATERIALS

MATERIALS (BIOLOGICAL)
See BIOLOGICAL MATERIALS

MATERIALS (BUILDING)
See BUILDING MATERIALS

MATERIALS (COMPOSITE)
See COMPOSITE MATERIALS

MATERIALS (DIELECTRIC)
See DIELECTRIC MATERIALS

MATERIALS (REINFORCED)
See REINFORCED MATERIALS

MATERIALS (SEMICONDUCTOR)
See SEMICONDUCTOR MATERIALS

MATERIALS TESTING
See also NONDESTRUCTIVE TESTING
Flaw assessment procedure for high temperature reactor components, 15:48580 (R;US)
Materials of construction and corrosion history for a low-level radioactive waste incinerator, 15:48294 (B;US)
R and D projects in reactor technology at the Swedish Plant Inspectorate (SA), 15:48536 (RA;XA)

MATHEMATICAL MODELS
See also COSMOLOGICAL MODELS
NUCLEAR MODELS
Modeling histogram data with piecewise polynomials, 15:50237 (R;US)

MATRIX MATERIALS
Influence of interfacial shear strength on the mechanical properties of SiC fiber reinforced reaction-bonded silicon nitride matrix composites, 15:48969 (R;US)
Theory and experimental technique for nondestructive evaluation of ceramic composites, 15:48967 (R;US)

MEASURING INSTRUMENTS
See also MAGNETOMETERS
RADIATION DETECTORS
SPECTROMETERS
SPECTROPHOTOMETERS
An automated linearity test for direct voltage calibrators, 15:49386 (R;US)
Fiber optic spectrochemical emission sensor: A detector for chlorinated and fluorinated compounds, 15:49638 (BA;US)
Quasiparticle mixers and detectors, 15:49319 (BA;US)
Statistical calibration and periodic performance checks for segmented gamma scanning, 15:48393 (R;US)

MELTDOWN
A suite of codes for the nuclear power plant design safety analysis, 15:48582 (RA;XA)
Investigations of water entrainment during hypothetical reactor accidents. Final report, 15:48637 (R;DE;In German)
Siemens UB KWU-Code package for severe accidents, 15:48560 (RA;XA)

MEMBER STATES
Communications received from Members regarding the export of nuclear material and of certain categories of equipment and other material: Further communications dated 1 June 1990, 15:48398 (R;XA)

MEMBRANES
Survey on solidification and utilization technology of CO_2, 15:49468 (R;JP;In Japanese)

MERCAPTANS
See THIOLS

MERCURY
Final best demonstrated available technology (BDAT) background for mercury-containing wastes D009, K106, P065, P092, and U151. Volume 17, 15:49491 (R;US)
Final response to BDAT related comments document. D009, K044, K045, K047, D011, P119, P120, and P and U wastes. Volume 1-I, 15:49524 (R;US)
Final response to BDAT related comments document. K071 and K106: Mercury cell process wastes K086: Residues from ink production wastes containing cyanide. Volume 1-L, 15:49608 (R;US)
Investigation in the propagation of mercury in groundwater of quaternary gravels, 15:49595 (RA;DE;In German)
On the removal of mercury from flue-gas scrub solutions by cementation, 15:48096 (R;DE)

MERCURY 190
Gamma ray from highly excited ^{190}Hg and ^{110}Sn, 15:50014 (RA;JP;In Japanese)

MERCURY 192
Population of superdeformed bands, the competition with fission, and the barrier between normal and superdeformed states, 15:50011 (R;US)

MERCURY ISOTOPES
See also MERCURY 190
MERCURY 192
Shape isomers at no spin, 15:50013 (R;FR)
Superdeformation in the mercury region, 15:50022 (R;US)

MERCURY PLANET
Geometrical and dynamical characteristics of the Earth, the Moon and Terrestrial planets. Part 1: 1.Topographic surfaces and Gravitational fields, 15:49812 (R;UA;In Russian)

MERCURY SULFIDES
A study of the thermoelectric properties of Ca, Sr and Hg substituted lanthanum sulfides, 15:48956 (R;US)

MESH GENERATION
An adaptive finite element technique using element equilibrium and paving, 15:50241 (R;US)

MESON RESONANCES
See MESONS

MESON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET

MESON-MESON INTERACTIONS
Amplitude analysis of $\gamma\gamma \rightarrow \pi\pi$ from threshold to 1.4 GeV, 15:49957 (R;GB)

MESONS
See also CHARMONIUM
STRANGE MESONS
VECTOR MESONS
Study of multiparticle correlations in 200-400 GeV range, 15:49992 (R;SU;In Russian)

METAGALAXY
See UNIVERSE
METAL-NONMETAL BATTERIES
See also LITHIUM-SULFUR BATTERIES
SODIUM-SULFUR BATTERIES
Electrochemical properties of solid electrolytes, 15:49110 (RA;US)
Surface layers on battery materials, 15:48693 (RA;US)
METALLIC GLASSES
On the diffusion in metallic glasses near the vitrification temperature, 15:48959 (R;UA;In Russian)
METALS
See also ACTINIDES
ALUMINIUM
CADMIUM
GERMANIUM
LEAD
MERCURY
SCRAP METALS
THALLIUM
TIN
ZINC
Atom Transport
Island structure growth and continuous film production criteria. 1. Weak atom sources, 15:48884 (R;UA;In Russian)
Chemical Reactions
Work in progress, 15:49058 (RA;US)
Coordination Valences
Formation of oxyacids of sulfur from SO_2, 15:49051 (RA;US)
Deposition
Surface morphology of metals in electrodeposition, 15:48684 (RA;US)
Dissolution
Surface morphology of metals in electrodeposition, 15:48684 (RA;US)
Emissivity
Investigations of defined oxides for improving the determination of emissivity of high temperatures. Pt. 1 and 2. Pt. 1: Determination of emissivity and optical constants. - Pt. 2: Preparation and analysis of probes, 15:48874 (R;DE;In German)
Energy Transfer
Energy transfer and structural studies of molecules on surfaces, 15:49125 (RA;US)
Films
Island structure growth and continuous film production criteria. 1. Weak atom sources, 15:48884 (R;UA;In Russian)
Molecular Models
Molecular mechanics study of the structure of lanthanide complexes, 15:49091 (BA;US)
Passivation
Laser Raman spectroscopy "for in-situ" analysis of corrosion films on metals, 15:48866 (R;US)
Point Defects
[Defects in close-packed metals and alloys]: Foreign trip report, August 9, 1990–August 22, 1990, 15:48896 (R;US)
Self-Diffusion
Application of ion beam sputtering for diffusion study in solids, 15:50065 (R;GB)
Stacking Faults
Determination of the stacking fault energies of face centured cubic metals and alloys by X-rays diffraction, 15:48875 (R;BR;In Portuguese)
Standards
Best demonstrated available technology (BDAT) background document for U and P wastes and multi-source leachate (F039). Volume C. Nonwastewater forms of organic U and P wastes and multi-source leachate (F039) for which there are concentration-based treatment standards. Final report, 15:49505 (R;US)
Final response to BDAT related comments document. K017/K028-K029, K095-096, K022, K025, K035, K026, K083, K024. Volume 1-M, 15:49527 (R;US)
Final response to BDAT related comments document: General BDAT issues. Volume 1-A-3, 15:49517 (R;US)
Final response to BDAT related comments document: General BDAT issues. Volume 1-A-2, 15:49516 (R;US)
Synthesis
Work in progress, 15:49058 (RA;US)
Thermal Conductivity
Thermal conductivity of metals, 15:48892 (RA;US)
Thin Films
Island structure growth and continuous film production criteria. 2. Strong atom sources, 15:48885 (R;UA;In Russian)
Wear Resistance
Wear-metal analysis in engine oil by microwave digestion and atomic absorption spectroscopy. Final report, August 1987-January 1988, 15:48988 (R;US)
X-Ray Diffraction
Determination of the stacking fault energies of face centured cubic metals and alloys by X-rays diffraction, 15:48875 (R;BR;In Portuguese)
METEOROLOGY
A Nuisance Alarm Data System for evaluation of intrusion detectors, 15:49379 (R;US)
Atmospheric processes over complex terrain: Volume 23, No. 45, 15:49458 (R;US)
METER WAVE RADIATION
See RADIOWAVE RADIATION
METHANE
Biological sources and sinks of methane in tropical habitats and tropical atmospheric chemistry. Doctoral thesis, 15:49532 (R;US)
On reduced mechanisms for methane-air combustion in non-premixed flames, 15:48438 (J;US)
METHANOL
Flotation and flocculation chemistry of coal and oxidized coals: Technical progress report, March 15, 1990–June 14, 1990, 15:48083 (R;US)
Work in progress, 15:49105 (RA;US)
METHYL ALCOHOL
See METHANOL
METHYL IODIDE
Crossed-molecular-beam studies of the reactions of methyl radicals with iodoalkanes, 15:49884 (RA;US)
Symmetric stretch excitation of CH_3 in the 193.3-nm photolysis of CH_3I, 15:49137 (RA;US)
METHYL PHENOLS
See CRESOLS
METHYL RADICALS
Crossed-molecular-beam studies of the reactions of methyl radicals with iodoalkanes, 15:49884 (RA;US)
METHYL-FUEL
See METHANOL
METHYLENE RADICALS
Rate constants for $^3CH_2$ (X^3B_1) removal by O_2, NO, and C_2H_2 from infrared-diode laser flash kinetic spectroscopy, 15:49039 (RA;US)
METHYLIDENE RADICALS
See METHYLENE RADICALS
METROPOLITAN AREAS
See URBAN AREAS
MICHELSON INTERFEROMETER
Two-wavelength, multi-channel, submillimeter laser interferometer for measurements of plasma density in T-15 tokamak, 15:50135 (RA;CS;In Russian)
MICROEMULSIONS
Molecular thermodynamics of partially ordered fluids: Microemulsions, 15:49067 (RA;US)
MICROPROCESSORS
Specialized processor for particle momentum selection in the experiment to study of central hadron collisions, 15:49298 (R;SU;In Russian)
MICROSCOPES
Design of thick apertures for high-resolution neutron penumbral imaging, 15:49327 (J;US)
MICROSCOPY
The photon scanning tunneling microscope, 15:49377 (R;US)
X-ray microprobe-microscopy, 15:49187 (R;US)

MICROWAVE EQUIPMENT
See also SQUID DEVICES
High-temperature superconductivity applications for electronic warfare and microwave systems. Final report, March 1988-March 1990, 15:49390 (R;US)
MIDDLE EAST
See also KUWAIT
Chemical weapons proliferation in the Middle East: What is the proper response. Study project, 15:48849 (R;US)
MIDWEST REGION
See FEDERAL REGION VII
MIGRATION
Molecular-dynamics study of grain-boundary migration in metals, 15:48860 (R;US)
MIGRATION (RADIONUCLIDE)
See RADIONUCLIDE MIGRATION
MILITARY FACILITIES
An infrared imaging area sensor for tactical and physical security applications, 15:48394 (R;US)
Task Order 2 enhanced preliminary assessment, Fort Douglas, Salt Lake City, Utah. Final report, October-December 1989, 15:49416 (R;US)
Task order enhanced preliminary assessment, New Orleans Military Ocean Terminal, New Orleans, Louisiana. Final report, October-December 1989, 15:49417 (R;US)
Waste-minimization opportunity assessment, Fort Riley, Kansas. Summary report, April 1989-December 1989, 15:49613 (R;US)
MILKY WAY
Velocity-resolved spectra of BRα and BRγ on IRS16 SW and NE, 15:49793 (RA;FR)
MINE ROADWAYS
Review and evaluation of main roadway intersection techniques for use in the Sydney coal field, 15:48102 (R;CA)
MINE SITE REHABILITATION
See REMEDIAL ACTION
MINE-MOUTH GENERATING PLANTS
See FOSSIL-FUEL POWER PLANTS
MINERAL INDUSTRY
Recycling of electric-arc-furnace dust, 15:48824 (R;US)
MINERAL OIL
See LUBRICANTS
MINERAL RESOURCES
See also COAL DEPOSITS
NATURAL GAS DEPOSITS
PETROLEUM DEPOSITS
Ecological characterization atlas of coastal Alabama: Map narrative, 15:49571 (R;US)
MINES
See also ASSE SALT MINE
The international Stripa project: Technology transfer from cooperation in scientific and technological research on nuclear waste disposal, 15:48334 (BA;US)
MINING ENGINEERING
Iowa State Mining and Mineral Resources Research Institute final report, July 1, 1988–June 30, 1989, 15:49737 (R;US)
MINNESOTA
Health assessment for Waste Engineering, Inc., Sanitary Landfill, Andover, Minnesota, Region 5. CERCLIS No. NMD9806091192 (amended). Final report, 15:49632 (R;US)
MINORITY GROUPS
Guide for the preparation of proposals for the pre-freshman enrichment program, PREP, 1991, 15:48834 (R;US)
MIRRORS
Holographic rugate structures for x-ray optics applications: Phase 2 Annual report, 15:49153 (R;US)
MISGURNUS
See FISHES
MISSISSIPPI
General design memorandum, Gulfport Harbor, Mississippi. Design Memorandum Number 1. Appendix E. Thin-layer disposal. Final report, 15:49587 (R;US)
Health assessment for Gautier Oil Co., Inc., Gautier, Mississippi, Region 4. CERCLIS No.MSD098596489. Preliminary report, 15:49534 (R;US)
MIXED CARBIDE FUELS
Irradiation program of the transuranium European institute in the HFR reactor, 15:48633 (RA;FR;In French)
MIXED NITRIDE FUELS
Irradiation program of the transuranium European institute in the HFR reactor, 15:48633 (RA;FR;In French)
MIXED OXIDE FUELS
Estimation of energy deposition in various test fuels in the NSRR FBR fuel tests, 15:48583 (R;JP;In Japanese)
Safety problems related to the use of MOX assemblies in PWRS, 15:48543 (R;FR)
Thermophysical and thermochemical properties of fast reactor materials, 15:48872 (R;FR)
MIXING
Effects of jet port arrangement on three-dimensional nonreacting jet -gas mixing in an MHD second stage combustor, 15:48106 (R;US)
MIXTURES
See also BINARY MIXTURES
SOLUTIONS
Correlation of liquid-liquid equilibria for some water-organic liquid systems in the region 20-250°C, 15:49071 (RA;US)
Stable carbon isotope analysis of coprocessing materials: Quarterly technical progress report, July 1–September 30, 1989, 15:48076 (R;US)
MM-0011
See NICKEL BASE ALLOYS
MODELS (COSMOLOGICAL)
See COSMOLOGICAL MODELS
MODELS (MATHEMATICAL)
See MATHEMATICAL MODELS
MODELS (NUCLEAR)
See NUCLEAR MODELS
MODELS (PLASMA)
See PLASMA SIMULATION
MODULAR CONSTRUCTION
See MODULAR STRUCTURES
MODULAR STRUCTURES
Advantages of a modular design approach for radiological instrumentation, 15:49561 (J;US)
NUHOMS modular spent-fuel storage system: Design, licensing and construction, 15:48233 (R;US)
MOLECULAR BEAMS
Crossed-molecular-beam studies of the reactions of methyl radicals with iodoalkanes, 15:49884 (RA;US)
Dynamics of endoergic substitution reactions. II. Br + (CH_2CCl_2) → Cl + (CH_2CClBr), 15:49883 (RA;US)
Dynamics of endoergic substitution reactions: I. Br + chlorinated aromatic compounds, 15:49882 (RA;US)
MOLECULAR BIOLOGY
Annual report and summaries of FY 1990 activities, 15:48413 (R;US)
Genetics and the unity of biology: Proceedings: Part 1 of 2, 15:49653 (R;CA)
Genetics and the unity of biology: Proceedings: Part 2 of 2, 15:49654 (R;CA)
[DNA repair and mutagenesis]: Foreign trip report, July 23, 1990–August 25, 1990, 15:49645 (R;US)
MOLECULAR FLUORESCENCE SPECTROSCOPY
See FLUORESCENCE SPECTROSCOPY
MOLECULAR ORBITAL MODEL
See MOLECULES
MOLECULAR SIEVES
Improved Fischer-Tropsch Synthesis catalysts for indirect coal liquefaction: Quarterly technical progress report No. 8, 1 July–30 September 1987, 15:48075 (R;US)
MOLECULE COLLISIONS
See also ATOM-MOLECULE COLLISIONS
ELECTRON-MOLECULE COLLISIONS
Rotational and temperature effects on Coulomb capture of muons by hydrogen molecules, 15:50190 (RA;GB)
The physics of electronic and atomic collisions, 15:49868 (B;US)
Theory of atomic and molecular collision processes, 15:50226 (RA;US)

MOLECULES
See also POLYATOMIC MOLECULES
A calculational study of empirical hydrogen-bonding scales, 15:49089 (BA;US)
Effect of fluctuations in state-specific unimolecular rate constants on the pressure dependence of the average unimolecular reaction rate, 15:50228 (RA;US)
Energy transfer and structural studies of molecules on surfaces, 15:49125 (RA;US)
Molecular interactions, 15:49145 (RA;US)
Selective photochemistry, 15:49126 (RA;US)
Spectroscopy and structures of reactive intermediates, 15:49155 (RA;US)

MOLTEN CARBONATE FUEL CELLS
Controlled-pore-size composite nickel oxide structures for carbonate fuel cell cathodes, 15:48765 (J;US)

MOLTEN SALT COOLANTS
See MOLTEN SALTS

MOLTEN SALTS
Structure of molten salts, 15:48949 (R;US)

MOLYBDATES
Formation of calcium and magnesium molybdate complexes in dilute aqueous solutions and evaluation of powellite solubility in spent oil shale, 15:48202 (R;US)

MOLYBDENUM
Catalytic treatment of pyrolysis oils, 15:48435 (R;LU)
Comparison between the tricaprylylamine and trilaurilamine extrability in uranium and molybdenum extraction of low concentration liquors, 15:48212 (R;BR;In Portuguese)
Thermal stresses in layered electrical assemblies bonded with solder, 15:49218 (R;US)

MOLYBDENUM 92 TARGET
Detection and experimental investigation of α-particle Wolf-Bragg scattering on quasicrystalline atomic nuclei, 15:49990 (R;SU;In Russian)

MOLYBDENUM 99
Radioisotopes production programmes for reactor radioisotopes, 15:48636 (RA;FR)

MOLYBDENUM ALLOYS
See also CHROMIUM-NICKEL-MOLYBDENUM STEELS
STEEL-CR9MONBV
High-resolution electron microscopy observations of athermal omega phase in Ti-Mo alloys, 15:48898 (R;US)

MOLYBDENUM COMPLEXES
Solvent and temperature dependence of the luminescence properties of binuclear metal complexes, 15:49095 (BA;US)
The chemistry of (fulvalene)-molybdenumruthenium(pentacarbonyl), 15:49054 (RA;US)

MOLYBDENUM HYDRIDES
Reactivity of metal dihydrogen complexes: Studies of Mo and W, 15:49092 (BA;US)

MOLYBDENUM OXIDES
Simultaneous particulates, NOx_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 9, July 1, 1989–September 30, 1989, 15:48511 (R;US)

MONGRELS
See DOGS

MONITORED RETRIEVABLE STORAGE
Institutional status, challenges, and plans related to the MRS program, 15:48362 (BA;US)
MRS role in reducing technical uncertainties in geological disposal, 15:48291 (R;US)

MONITORING (RADIATION)
See RADIATION MONITORING

MONITORS (AIR POLLUTION)
See AIR POLLUTION MONITORS

MONJU REACTOR
Estimation of energy deposition in various test fuels in the NSRR FBR fuel tests, 15:48583 (R;JP;In Japanese)

MONOCHROMATORS
Modernization of the VMR-2 monochromator and its use in a synchrotron radiation channel, 15:49243 (R;SU;In Russian)

MONOCLONAL ANTIBODIES
Introduction of astatine into monoclonal antibodies, 15:49150 (R;SU;In Russian)

MONOPOLES
See also MAGNETIC MONOPOLES
Synthesis of oneparticle excitation from two giant quantum monopoles, 15:50093 (R;SU;In Russian)

MONTE CARLO METHOD
Calculation of Monte Carlo importance functions for use in nuclear-well logging calculations, 15:49375 (J;US)
Monte Carlo codes and Monte Carlo simulator program, 15:50221 (R;JP;In Japanese)
Parallelization of a radiation transport simulation code on the BBN TC2000™ parallel computer, 15:49285 (R;US)
Random number stride in Monte Carlo calculations, 15:50103 (R;US)

MOON
Discussion paper on environmental hazards on the Moon, in low Earth orbit, and in low Mars orbit, 15:49817 (R;US)
Geometrical and dynamical characteristics of the Earth, the Moon and Terrestrial planets. Part 1: 1.Topographic surfaces and Gravitational fields, 15:49812 (R;UA;In Russian)

MOS TRANSISTORS
Measurement of proton induced radiation damage to CMOS transistors and PIN diodes, 15:49374 (J;US)

MU SR
See MUON SPIN RELAXATION

MULE DEER
See DEER

MULTI-CHANNEL ANALYZERS
Study on the main performance of charged particle multichannel spectrometers at high input counting rates, 15:49295 (R;SU;In Russian)

MULTICHARGED IONS
Atomic physics of highly charged ions in an electron beam ion trap, 15:49895 (R;US)
Semiempirical studies of atomic structure: Progress report, July 1, 1990–June 30, 1991, 15:49874 (R;US)

MULTIPLICITY
Charged pion production in nucleus-nucleus collisions AT E/A between 400 and 800 MeV, 15:49982 (R;FR;In French)

MULTIPROCESSING
See PARALLEL PROCESSING

MULTIPROCESSORS
See ARRAY PROCESSORS

MULTIWIRE DRIFT CHAMBERS
See DRIFT CHAMBERS

MULTIWIRE IONIZATION CHAMBERS
A many particle-tracking detector with drift planes and segmentel cathode readout, 15:49267 (J;US)
A study of wire chambers with highly segmented cathode pad readout for high multiplicity charged particle detection, 15:49323 (J;US)

MULTIWIRE PROPORTIONAL CHAMBERS
See also DRIFT CHAMBERS
Experimental study of the single electron response of the DELPHI Barrel RICH MWPC's, 15:49287 (R;FR)
Low-pressure chamber for registration of fission fragments of heavy nuclei, 15:49289 (R;SU)
Performance studies of a multiwire chamber, with 1 mm anode wire spacing, to be used for 2-D position-sensitive detection of x-rays, 15:49326 (J;US)
Possibility of experiments using radiation counters for test electron stability and Pauli principle violation in atoms, 15:49303 (R;SU;In Russian)
Study of plasma chemistry in wire chambers by GC/MS, 15:49370 (J;US)
Test of the HISPET prototype, 15:49353 (J;US)

MUNICIPAL BUILDINGS
See PUBLIC BUILDINGS

MUNICIPAL WASTES
Assessment of municipal solid waste for energy production in the western United States, 15:48833 (R;US)

Municipal solid waste feasibility of gasification with plasma arc: Phase 2. Environmental analyses, 15:48436 (RA;CA)

MUON SPIN RELAXATION
Spin dynamics of the itinerant helimagnet MnSi studied by positive muon spin relaxation, 15:50029 (R;JP)

MUON SPIN RESONANCE
See MUON SPIN RELAXATION

MUON SPIN ROTATION
See MUON SPIN RELAXATION

MUON-CATALYZED FUSION
Deuterium
μCF studies in University of Tsukuba, 15:50193 (RA;GB)
Diffusion of muonic hydrogen atoms, 15:50189 (RA;GB)
Experimental investigation of muon-catalysed fusion in pure deuterium: current status and future possibilities, 15:50183 (RA;GB)
Phase space, meson exchange and the photon connection in sticking, 15:50195 (RA;GB)
Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989, 15:50182 (R;GB)
Resonances in muonic systems, 15:50194 (RA;GB)
Deuterium Tritide
Interpretation of recent LAMPF results on dtμ formation, 15:50185 (RA;GB)
Fusion Yield
Review of μCF and new LAMPF results, 15:50184 (RA;GB)
Hydrogen 1
μCF studies in University of Tsukuba, 15:50193 (RA;GB)
Meetings
Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989, 15:50182 (R;GB)
Muonic Atoms
Angular-momentum alignment effects under slowing-down of muonic helium ion in the μ CF, 15:50196 (RA;GB)
Muonic Molecules
Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989, 15:50182 (R;GB)
Nuclear Reaction Kinetics
New results in muon catalyzed pd fusion, 15:50187 (RA;GB)
Tritium
μCF studies in University of Tsukuba, 15:50193 (RA;GB)
Diffusion of muonic hydrogen atoms, 15:50189 (RA;GB)
Phase space, meson exchange and the photon connection in sticking, 15:50195 (RA;GB)
Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989, 15:50182 (R;GB)
Resonances in muonic systems, 15:50194 (RA;GB)
Very Low Temperature
Interpretation of recent LAMPF results on dtμ formation, 15:50185 (RA;GB)
New results in muon catalyzed pd fusion, 15:50187 (RA;GB)

MUONIC ATOMS
Angular-momentum alignment effects under slowing-down of muonic helium ion in the μ CF, 15:50196 (RA;GB)

MUONIC MOLECULES
μCF studies in University of Tsukuba, 15:50193 (RA;GB)
Diffusion of muonic hydrogen atoms, 15:50189 (RA;GB)
Emission of muonic hydrogen isotopes from solid hydrogen layers into vacuum, 15:50188 (RA;GB)
Experiment for direct measurement of final sticking ω_s in muon catalyzed dt fusion, 15:50186 (RA;GB)
New results in muon catalyzed pd fusion, 15:50187 (RA;GB)
Resonances in muonic systems, 15:50194 (RA;GB)

MUONS
See also MUONS MINUS
μ particle detector, 15:49313 (RA;JP;In Japanese)
Rotational and temperature effects on Coulomb capture of muons by hydrogen molecules, 15:50190 (RA;GB)
Supersymmetric version of horizontal gauge interactions, 15:49931 (R;SU)

MUONS MINUS
μCF studies in University of Tsukuba, 15:50193 (RA;GB)
Angular-momentum alignment effects under slowing-down of muonic helium ion in the μ CF, 15:50196 (RA;GB)
Experiment for direct measurement of final sticking ω_s in muon catalyzed dt fusion, 15:50186 (RA;GB)
Phase space, meson exchange and the photon connection in sticking, 15:50195 (RA;GB)
Resonances in muonic systems, 15:50194 (RA;GB)
Review of μCF and new LAMPF results, 15:50184 (RA;GB)

MUSSELS
US Mussel Watch Program: Transuranic element data from Woods Hole Oceanographic Institution 1976-1983. Technical report, 15:49610 (R;US)

MUTAGENESIS
[DNA repair and mutagenesis]: Foreign trip report, July 23, 1990–August 25, 1990, 15:49645 (R;US)

MWPC
See MULTIWIRE PROPORTIONAL CHAMBERS

N

N*BARYONS
Perspectives of experimental study of electromagnetic form factors of unstable particles at UNK, 15:49911 (R;SU;In Russian)

N*RESONANCES
See N*BARYONS

N-REACTOR
N reactor external events probabilistic risk assessment using NUREG-1150 methods, 15:48669 (R;US)

NAI DETECTORS
Possibility of experiments using radiation counters for test electron stability and Pauli principle violation in atoms, 15:49303 (R;SU;In Russian)
The shuttle activation monitor: A system for direct comparison of gamma-ray detector materials in a space environment, 15:49362 (J;US)

NAL SYNCHROTRON
See FERMILAB ACCELERATOR

NAPHTHA
Upgrading Fischer-Tropsch naphtha, 15:48078 (R;US)

NARORA-1 REACTOR
Pre-operational external radiation monitoring in NAPP environs using TLDs (Jan 1987 - Mar 1989), 15:50061 (R;IN)

NARORA-2 REACTOR
Pre-operational external radiation monitoring in NAPP environs using TLDs (Jan 1987 - Mar 1989), 15:50061 (R;IN)

NATIONAL ACCELERATOR LABORATORY
See FERMILAB ACCELERATOR

NATIONAL DEFENSE
See also BALLISTIC MISSILE DEFENSE
Strategic Defense Initiative three reasons to stay the course. Individual study project, 15:49407 (R;US)

NATURAL ACTIVITY
See NATURAL RADIOACTIVITY

NATURAL GAS
See also LIQUEFIED NATURAL GAS
A handbook for management of oil and gas activities on lands in Alaska: Petroleum industry practices, environmental impacts and stipulations, 15:48149 (R;US)
Alberta oil and gas industry annual statistics, 1988, 15:48133 (R;CA)
Alberta's reserves of crude oil, oil sands, gas, natural gas liquids, and sulphur, 15:48131 (R;CA)
Co-firing of natural gas and coal. Annual report, October 1988-September 1989, 15:48121 (R;US)
Commercial sector gas cooling technology frontier and market share analysis, 15:48771 (R;US)
Gas Research Institute 1991-1995 research and development plan and 1991 research and development program, 15:48177 (R;US)

Gulf of Mexico sales 131, 135, and 137: Central, Western, and Eastern planning areas: Final environmental impact statement: Volume 2, Sections IV.D. and IX, 15:48154 (R;US)
Natural gas monthly, June 1990, 15:48180 (R;US)
Outlook for demand growth in Asian countries, 15:48698 (RA;CA)
Physical Sciences Program Area 1990 contract status report, 15:48178 (R;US)
Potential issues associated with shipping oil and gas through the Labrador Sea and Strait of Belle Isle, 15:48170 (R;CA)
US oil and gas reserves by year of field discovery, 15:48125 (R;US)

NATURAL GAS DEPOSITS
Geologic interpretation of gravity anomalies, 15:48124 (R;US)
Geology of the Stoney Creek oil and gas field, and its implications regarding the tectonic evolution of the eastern Moncton subbasin, New Brunswick. Geoscience report No. 89-1, 15:48130 (R;CA)
Organic chemistry of mantle-derived xenoliths: Assessing the possibilities for deep sources of natural gas. Biennial report, November 1987-November 1989, 15:48179 (R;US)

NATURAL GAS DISTRIBUTION SYSTEMS
Pressure history of a gas pipeline, 15:48189 (R;CA)
State-of-the-art interior-piping-systems application: On-site H_2S/O_2 removal technology. Final report, June 1988-March 1989, 15:48190 (R;US)
State-of-the-art interior-piping-systems applications: Commercial buildings. Final report, June 1987-June 1989, 15:48792 (R;US)

NATURAL GAS GATHERING SYSTEMS
See NATURAL GAS DISTRIBUTION SYSTEMS

NATURAL GAS INDUSTRY
Environmental Studies Research Funds annual report, 1989, 15:48747 (R;CA)
Gas Research Institute 1991-1995 research and development plan and 1991 research and development program, 15:48177 (R;US)
Natural gas monthly, June 1990, 15:48180 (R;US)
Physical Sciences Program Area 1990 contract status report, 15:48178 (R;US)
U.S. regulatory environment, 15:48738 (RA;CA)

NATURAL GAS PROCESSING PLANTS
A technical and economic evaluation of sulphur basepad recovery and reclamation, 15:49585 (RA;CA)

NATURAL GAS WELLS
Alberta oil and gas industry annual statistics, 1988, 15:48133 (R;CA)

NATURAL GASOLINE PLANTS
See NATURAL GAS PROCESSING PLANTS

NATURAL RADIOACTIVITY
A study of radon variation in dwelling during 1988, 15:50062 (R;IN)
Pre-operational external radiation monitoring in NAPP environs using TLDs (Jan 1987 - Mar 1989), 15:50061 (R;IN)

NATURAL URANIUM
A technical and economic comparison of the conversion of natural and oxide reactor reprocessed uranium, 15:48243 (RA;XA)

NATURE RESERVES
Texas Barrier Islands Region ecological characterization atlas: Socioeconomic and natural features narrative, 15:49569 (R;US)

NEBULAE
See also PLANETARY NEBULAE
A survey of PAH emission in HII regions, planetary and protoplanetary nebulae, 15:49784 (RA;FR)
Ice grains in the dust disk of the bipolar nebula M 1-92, 15:49782 (RA;FR)
Interpretation of the 10 μ m and 20 μ m absorption bands in comets, the ism and in an external galaxy, 15:49758 (RA;FR)
Mapping and spectroscopy of the 3.3 μm feature in Orion, 15:49773 (RA;FR)
Nebulous matter, 15:49828 (RA;ZA)
Polycyclic aromatic hydrocarbons in the infrared spectra of IRAS sources, 15:49765 (RA;FR)

NEGATONS
See ELECTRONS

NEGATRONS
See ELECTRONS

NEODYMIUM CHLORIDES
Structure of molten salts, 15:48949 (R;US)

NEODYMIUM COMPLEXES
On the stability and bonding in bis(η-arene)lanthanide complexes, 15:49063 (RA;US)

NEODYMIUM LASERS
Diode laser-pumped single-mode 1.3-microns Nd: YALO microlaser. Final report, 15:49203 (R;US)

NEON 20 REACTIONS
Charged pion production in nucleus-nucleus collisions at E/A between 400 and 800 mev, 15:50007 (R;FR;In French)

NEON 20 TARGET
Search for strangeness-abundant quark-gluon matter in nucleus-nucleus and antiproton-nucleus interactions, 15:50042 (R;SU;In Russian)

NEOPRENE
Thin-film composite materials, Phase 2. Final report, 1 April-31 December 1986, 15:48948 (R;US)

NERVE CELLS
Analysis of soil samples for chemical warfare agents: Canadian contribution to a multinational round-robin analytical exercise. Memorandum report, 15:49409 (R;US)

NERVOUS SYSTEM
See also CENTRAL NERVOUS SYSTEM
Oscillation onset in neural delayed feedback, 15:49704 (R;US)

NET TOKAMAK
Irradiation testing for fusion technology. Current programme and future plans of KfK, 15:50170 (RA;FR)
Joint research centre fusion materials irradiations in HFR: Present status and prospectives, 15:50173 (RA;FR)
KFA Neutron irradiation programme on materials for high heat load components of fusion devices, 15:50171 (RA;FR)
Prestudy of burn control in NET: Second intermediate report, February 1990, 15:50113 (R;SE)
The function of the HFR, Petten, in the development of plasma facing components for fusion reactors, 15:50172 (RA;FR)

NEURAL NETWORKS
A unified framework for credit assignment, 15:50214 (R;US)
Classification of acoustic emission waveforms for nondestructive evaluation using neural networks, 15:50239 (R;US)
Sensor validation for power plants using adaptive backpropagation neural network, 15:48616 (J;US)

NEURONS
See NERVE CELLS

NEUTRALIZATION (CHEMICAL)
See PH VALUE

NEUTRINO OSCILLATION
Study of neutrino oscillations in the frejus experiment, 15:49915 (R;FR)

NEUTRINOS
See also SOLAR NEUTRINOS
Cosmological baryon and lepton number in the presence of electroweak fermion-number violation, 15:49820 (R;US)

NEUTRON BEAMS
Application of reactor neutrons for activation analysis, 15:48626 (RA;FR)
Neutron scattering in solid state physics and materials science, 15:48625 (RA;FR)
Nuclear physics at the HFR, 15:48624 (RA;FR)
Prospects and future utilization, 15:48621 (R;FR;In EN, DE)

NEUTRON CAPTURE
See NEUTRON REACTIONS

NEUTRON CAPTURE THERAPY
Clinical possibilities of neutron capture therapy, 15:49689 (RA;FR)

NEUTRON DETECTION
Experiment for direct measurement of final sticking ω_s in muon catalyzed dt fusion, 15:50186 (RA;GB)

NEUTRON DETECTORS
Design of thick apertures for high-resolution neutron penumbral imaging, 15:49327 (J;US)

Multi-energy neutron detector for counting thermal neutrons, high-energy neutrons, and gamma photons separately, 15:49364 (J;US)

NEUTRON DIFFRACTION
Neutron scattering in solid state physics and materials science, 15:48625 (RA;FR)

NEUTRON DIFFUSION EQUATION
A nodal method for the solution of the static, few-group diffusion equations in hexagonal geometry, 15:48593 (R;US)
To the problem of optimization of external and integral iteration algorithm in diffusion calculation of nuclear reactor, 15:48594 (R;SU;In Russian)

NEUTRON DOSIMETRY
Neutron detection based on superheated materials, 15:49355 (J;US)

NEUTRON ECONOMY
See NEUTRON FLUX

NEUTRON FLUX
Rod drop in the LR-0 reactor core comprising 55 fuel assemblies: A comparison of theoretical and experimental data, 15:48599 (R;CS;In Russian)

NEUTRON FLUX DENSITY
See NEUTRON FLUX

NEUTRON GUIDES
The design and construction of the neutron guide tubes in JRR-3, 15:48631 (R;JP;In Japanese)

NEUTRON LEAKAGE
The neutron leakage spectrum for an iron sphere with a central 14 MeV neutron source, 15:50056 (R;XA)

NEUTRON MATTER
See NUCLEAR MATTER

NEUTRON RADIOGRAPHY
Neutron radiography, 15:48405 (RA;FR)
The Neutron Radiography Reactor (NRAD), 15:48620 (R;US)

NEUTRON REACTIONS
ACTIV87 Fast neutron activation cross section file 1987, 15:49985 (R;XA)
BROND: USSR Evaluated Neutron Data Library, 15:49984 (R;XA)
ENDF/B-4: General purpose file 1974. Summary of contents and documentation, 15:50252 (R;XA)
General purpose nuclear data evaluations for ENDF/B-VI: Impact of cross-section standards, 15:49993 (R;US)
Interference of the main diagrams of OPER-model for reaction $np \rightarrow np\,\pi^+\pi^-$ at energies 1-5 GeV, 15:50035 (RA;SU;In Russian)
Microscopic integral cross section measurements in the Be(d,n) neutron spectrum for applications in neutron dosimetry, radiation damage and the production of long-lived radionuclides, 15:49980 (R;US)
Nuclear reaction cross sections recommended as the standards for neutron measurements, 15:49981 (R;SU;In Russian)
Thermal-neutron capture gamma-rays, 15:49987 (R;XA)
Threshold anomaly in doublet nd-scattering, 15:50033 (R;UA)
"ACTV-F/H" Neutron activation cross-section library for fusion reactor design: Data from the Hanford REAC*2 Data Library, 15:49986 (R;XA)

NEUTRON SOURCE FACILITIES
FEhl pulse spectrometric neutron generator, 15:49228 (R;SU;In Russian)

NEUTRON SOURCES
A programmable multichannel correlation module for analyzing neutron multiplicities, 15:49337 (J;US)
Advanced Neutron Source: The designer's perspective, 15:48404 (R;US)
Advanced Neutron Source: The users' perspective, 15:48403 (R;US)
Cold neutron source as heat pipe, 15:49182 (RA;JP;In Japanese)
ISIS status and prospects, November 1989, 15:49263 (RA;JP)
Neutron beam characterization at the Neutron Radiography Reactor (NRAD), 15:48402 (R;US)
[New techniques and design approaches of neutron scattering facilities]: Foreign trip report, July 1, 1990–July 30, 1990, 15:48407 (R;US)

NEUTRON SPECTRA
The high-energy neutron spectrometry in mixed indirectional radiation fields behind accelerator shielding, 15:49261 (R;SU)

NEUTRON STARS
Axions and SN 1987A: Axion trapping, 15:49824 (R;US)
Distance limits for gamma-ray bursts from galactic neutron stars, 15:49843 (BA;US)

NEUTRON TRANSPORT
FORTUN-88 physical module for calculation by Monte-Carlo method with microconstants on the estimated data file basis, 15:50054 (R;SU;In Russian)
Monte Carlo next-event estimates from thermal collisions, 15:50060 (R;US)
On the adequacy of message-passing parallel supercomputers for solving neutron transport problems, 15:50053 (R;US)

NEUTRON-GAMMA LOGGING
MCNP capabilities for nuclear well logging calculations, 15:49376 (J;US)

NEUTRONS
See also COLD NEUTRONS
THERMAL NEUTRONS
Cold fusion and tritium, 15:50199 (RA;GB)
Deuteron $A(Q^2)$ structure function and the neutron electric form factor, 15:49904 (R;FR)
Response to queries regarding "Observation of cold nuclear fusion in condensed matter", 15:50200 (RA;GB)
[New techniques and design approaches of neutron scattering facilities]: Foreign trip report, July 1, 1990–July 30, 1990, 15:48407 (R;US)

NEW BRUNSWICK
Background discussion document on energy in New Brunswick, 1990-2000, 15:48744 (R;CA)
Background discussion document on energy in New Brunswick, 1990-2000, 15:48745 (R;CA)
Draft guidelines for an environmental impact assessment: N.B. Power, Millbank Generating Station, 15:48151 (R;CA)
Geology of the Stoney Creek oil and gas field, and its implications regarding the tectonic evolution of the eastern Moncton subbasin, New Brunswick. Geoscience report No. 89-1, 15:48130 (R;CA)
Guidelines for an environmental impact assessment of a 345 kV transmission line from Salisbury to Bathurst/Belledune, 15:48682 (R;CA)
Guidelines for an environmental impact assessment of a 345-kV transmission line from Salisbury to Bathurst/Belledune, 15:48680 (R;CA)
Guidelines for an environmental impact assessment of the second New England intertie 345-kV transmission line, 15:48679 (R;CA)
Guidelines for an environmental impact assessment of the second New England intertie 345 kV transmission line, 15:48681 (R;CA)

NEW ENGLAND
See FEDERAL REGION I

NEW HAMPSHIRE
Health assessment for Fletcher's Paint Works and Storage Facility Hazardous Waste Material, Milford, Hillsborough County, New Hampshire, Region 1. CERCLIS No. NHD981067614. Preliminary report, 15:49615 (R;US)
Health assessment for South Municipal Water Supply Well, Hillsborough County, Peterborough, Cheshire County, New Hampshire, Region 1. CERCLIS No. NHD980671069. Final report, 15:49616 (R;US)

NEW JERSEY
Health assessment for Cinnaminson Township (Block 702) Ground-Water Contamination, Cinnaminson, Burlington County, New Jersey, Region 2. CERCLIS No. NJD980785638. Final report, 15:49621 (R;US)
Health assessment for Ewan Property, Shamong Township, Burlington County, New Jersey, Region 2. CERCLIS No. NJD980761365. Final report, 15:49626 (R;US)
Health assessment for Imperial Oil Co., Inc./Champion Chemicals, Marlboro Township, Monmouth County, New Jersey,

Region 2. CERCLIS No. NJD980654099. Final report, 15:49624 (R;US)
Health assessment for Landfill and Development Company, Mount Holly, New Jersey, Region 2. CERCLIS No. NJD048044325. Final report, 15:49611 (R;US)
Health assessment for Radiation Technology, Inc., Rockaway, Morris County, New Jersey, Region 2. CERCLIS No. NJD047684451. Final report, 15:49625 (R;US)
Superfund Record of Decision (EPA Region 2): Roebling Steel, NJ. (First remedial action), March 1990, 15:49631 (R;US)

NEW MEXICO
Evaluation of unrecovered mobile oil in Texas, Oklahoma, and New Mexico, 15:48136 (BA;US)

NEXT EUROPEAN TORUS
See NET TOKAMAK

NICKEL
Catalytic treatment of pyrolysis oils, 15:48435 (R;LU)
Consistency of microscopic evaluations and integral experiments for chromium, iron and nickel, 15:50009 (R;XA)
Final response to BDAT related comments document. K017/K028-K029, K095-096, K022, K025, K035, K026, K083, K024. Volume 1-M, 15:49527 (R;US)
Laser Raman spectroscopy "for in-situ" analysis of corrosion films on metals, 15:48866 (R;US)
Surface phases and their influence on metal-oxide interfaces: [Progress report], 15:48869 (R;US)
Wear-metal analysis in engine oil by microwave digestion and atomic absorption spectroscopy. Final report, August 1987-January 1988, 15:48988 (R;US)

NICKEL 58 REACTIONS
Central collisions at the fermi energy, 15:50012 (R;FR)

NICKEL ALLOYS
See also ALLOY-FE44NI33CR21
NICKEL BASE ALLOYS
In-situ studies of ion irradiation effects in an electron microscope, 15:48985 (J;US)
Mechanical properties, fracture behavior, and grain-boundary chemistry of B-doped NiAl, 15:48867 (R;US)
The interaction of point defects with line dislocations in HVEM [high voltage electron microscope] irradiated Fe-Ni-Cr alloys, 15:48862 (R;US)
The stability of irradiation-induced defects in NiAl, 15:48864 (R;US)

NICKEL BASE ALLOYS
Corrosion fatigue crack propagation in metals, 15:48893 (R;US)
Surface phases and their influence on metal-oxide interfaces: [Progress report], 15:48869 (R;US)

NICKEL COMPOUNDS
See also NICKEL FLUORIDES
NICKEL OXIDES
Distribution of a crystalline nickel (II) porphyrin in the Green River Formation, 15:48206 (R;US)

NICKEL FLUORIDES
A general method for the synthesis of polymeric binary fluorides exemplified by AgF_3, NiF_4, RuF_4, and OsF_4, 15:49099 (RA;US)

NICKEL OXIDES
Controlled-pore-size composite nickel oxide structures for carbonate fuel cell cathodes, 15:48765 (J;US)

NICKEL-HYDROGEN BATTERIES
Terrestrial nickel/hydrogen battery evaluation, 15:48468 (R;US)

NIOBIUM
Analysis of deformation characteristics of a heavily deformed Cu- 20%Nb composite, 15:48880 (R;US)

NIOBIUM ALLOYS
See also NIOBIUM BASE ALLOYS
Growth and deformation mechanisms of refractory-alloy hybrid materials. Final report, September 1986-September 1989, 15:48903 (R;US)

NIOBIUM BASE ALLOYS
Nuclear magnetic resonance survey of hydrogen motion and electronic structure in α-phase (Nb-Mo)-H alloys, 15:50075 (R;US)

NITRATES
See also RUBIDIUM NITRATES
SILVER NITRATES
Summary of the NAPAP state of science report on deposition monitoring in North America, 1979–1987, 15:49457 (R;US)

NITRIC ACID
Acid air pollutant mixtures: Respiratory system responses and effects of exercise, 15:49720 (R;US)
Inhalation toxicology of combined acid and soot particles. Final report, 15:49719 (R;US)
Nitrate reductase is induced in red spruce by NO_2 and HNO_3 vapor, 15:49726 (J;US)

NITRIC OXIDE
Resonance ionization spectroscopy of molecular clusters using picosecond lasers, 15:48992 (R;US)
Strategies for utilizing ferrous*EDTA chelate as an additive in combined SO_2/NO_x aqueous scrubbing systems, 15:48499 (R;US)

NITRO COMPOUNDS
See also NITROBENZENE
Preparation and properties of 3-amino-5-nitro-1,2,4-triazole, 15:49392 (R;US)

NITROBENZENE
Best demonstrated available technology (BDAT) background document for distillation bottoms from the production of nitrobenzene by the nitration of benzene K025. Final report, 15:49508 (R;US)

NITROGEN
Observation of correlation effects in zero kinetic energy electron spectra near the N1s and C1s thresholds in N_2, CO, C_6H_6, and C_2H_4, 15:49131 (RA;US)
Pollution load on the gulf of Finland in 1982-1984, 15:49636 (R;FI)
Unenhanced surface Raman spectroscopy of nitrogen physisorbed on Ag(111), 15:49076 (RA;US)

NITROGEN 14 REACTIONS
Central collisions at the fermi energy, 15:50012 (R;FR)

NITROGEN 15 TARGET
Neutron cross-section evaluation for ^{15}N, 15:49999 (R;XA)

NITROGEN DIOXIDE
Biological effects of combined exposure to coal fly ash and nitrogen dioxide. 3.: Morphological changes in respiratory organs of golden hamster, 15:48122 (R;JP;In Japanese)
Influence of experimental pulmonary emphysema on toxicological effects from inhaled nitrogen dioxide and diesel exhaust. Research report, January 1984-September 1987, 15:49721 (R;US)
Nitrate reductase is induced in red spruce by NO_2 and HNO_3 vapor, 15:49726 (J;US)
Nitrogen dioxide and respiratory infection: Pilot investigations. Research report, January 1984-September 1987, 15:49536 (R;US)

NITROGEN NITRIDES
See NITROGEN

NITROGEN OXIDES
See also NITRIC OXIDE
NITROGEN DIOXIDE
Best demonstrated available technology (BDAT) background document for U and P wastes and multi-source leachate (F039). Volume E. Gaseous U and P wastes. Final report, 15:49514 (R;US)
Comprehensive report to Congress, Clean Coal Technology Program: Full-scale demonstration of low-NOsub x cell burner retrofit, 15:48501 (R;US)
Innovative Clean Coal Technology (ICCT): 180 MW demonstration of advanced wall-fired combustion techniques for the reduction of nitrogen oxides (NOx) emissions from coal-fired boilers: Quarterly technical progress report, first quarter 1990, 15:48513 (R;US)
Limb demonstration project extension: Quarterly report No. 12, February, March, and April, 1990, 15:48502 (R;US)
Members committee report: Critical point one, 15:49465 (R;CA)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 5, July 1, 1988–September 30, 1988, 15:48507 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress

report No. 6, October 1, 1988–December 31, 1988, 15:48508 (R;US)
Simultaneous particulates, NOx_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 9, July 1, 1989–September 30, 1989, 15:48511 (R;US)

NMR
See NUCLEAR MAGNETIC RESONANCE

NON-PROLIFERATION TREATY
Twentieth anniversary of the entry into force of the Treaty on the Non-Proliferation of Nuclear Weapons, 15:48847 (R;XA)

NONAXIAL NUCLEI
See DEFORMED NUCLEI

NONDESTRUCTIVE TESTING
PISC III: Third programme for the inspection of steel components, 15:48606 (RA;XA)
Research activities in materials assessment, selection and development, fracture mechanics and non-destructive testing in Switzerland, 15:48523 (RA;XA)

NONLINEAR OPTICS
Influence of electron withdrawing groups and molecular conformation on the nonlinear optical response of derivatized phosphazenes, 15:49085 (BA;US)
Strategy and tactics in the search for new harmonic generating crystals, 15:49094 (BA;US)

NONLINEAR PROBLEMS
Convergence of numerical schemes suitable for two dimensional nonlinear convection: application to the coupling of modes in a plasma, 15:50092 (R;FR;In French)

NONLINEAR SYSTEMS
See NONLINEAR PROBLEMS

NONLUMINOUS MATTER
A model for the distribution of dark matter, galaxies, and the intergalactic medium in a cold dark matter-dominated universe, 15:49838 (BA;US)
Development of a cryogenic dark matter detector, 15:49344 (J;US)
Evolution of light domain walls interacting with dark matter, part 1, 15:49821 (R;US)

NONRADIOACTIVE WASTE DISPOSAL
See WASTE DISPOSAL

NORTH ATLANTIC REGION
See FEDERAL REGION I

NORTHWEST TERRITORIES
Uppermost Devonian and lower Carboniferous stratigraphy, sedimentation, and diagenesis, southwestern District of Mackenzie and southeastern Yukon Territory (NTS 95 B, C, F, and G), 15:49736 (R;CA)

NOTCHES
Characterization of short fatigue cracks at notches in SiC particulate aluminum composite, 15:48957 (R;US)

NOVA FACILITY
Design of thick apertures for high-resolution neutron penumbral imaging, 15:49327 (J;US)

NOVA SCOTIA
Electrical generating station proposal: Complete verbatim transcript, 15:48515 (R;CA)
Geotechnical study of rock-mass classification parameters for Sydney coal field, Nova Scotia, 15:48100 (R;CA)
Nova Scotia Power Corporation. Sixty-ninth annual report, 1988/1989, 15:48518 (R;CA)
Nova Scotia oil and gas report, 1986, 15:48748 (R;CA)
Report and recommendations regarding the environmental-assessment report for the proposed Point Aconi electrical generating station, 15:48099 (R;CA)

NOVAE
Binary star phenomena, 15:49829 (RA;ZA)
Infrared spectroscopy of novae and related objects, 15:49778 (RA;FR)

NOXSO PROCESS
Proof of concept testing of the advanced NOXSO flue gas cleanup process: Quarterly technical progress report, April 1–June 30, 1990, 15:48512 (R;US)

NOZZLES
Study of asymmetric supersonic jet flow for ejectors, 15:48805 (R;US)

NPR REACTOR
See N-REACTOR

NUCLEAR ACCIDENTS
See ACCIDENTS

NUCLEAR ATTACKS
See NUCLEAR WEAPONS

NUCLEAR CONTROVERSY
See HUMAN POPULATIONS

NUCLEAR DATA COLLECTIONS
ENDF/B-4: General purpose file 1974. Summary of contents and documentation, 15:50252 (R;XA)
Index of data libraries available on magnetic tape from the IAEA Nuclear Data Section, 15:50251 (R;XA)
Index to the IAEA-NDS-Documentation Series, 15:50250 (R;XA)

NUCLEAR DEFORMATION
Pair correlation of super-deformed rotation band, 15:50050 (RA;JP;In Japanese)

NUCLEAR DETERRENCE
Analysis of the morality of intention in nuclear deterrence, with special reference to final retaliation. Doctoral thesis, 15:48846 (R;US)

NUCLEAR EMULSIONS
Identification of cosmic heavy nuclei in an assembly of nuclear photoemulsions and dielectric track detectors, 15:49292 (R;SU;In Russian)

NUCLEAR ENGINEERING
US Nuclear Engineering Education: Status and prospects, 15:48835 (R;US)

NUCLEAR EXPLOSION DETECTION
Regional discrimination of quarry blasts, earthquakes and underground nuclear explosions. Final report, 23 March 1987-22 March 1989, 15:49403 (R;US)
Stability of RMS Lg measurements and their potential for accurate estimation of the yields of Soviet underground nuclear explosions. Technical report, November 1989-31 January 1990, 15:49402 (R;NO)

NUCLEAR EXPLOSIONS
Environmental corrections for a neutron-induced gamma-ray spectroscopy logging system in an air-filled borehole, 15:49401 (J;US)
Laboratory particle-velocity experiments on rock from a USSR underground nuclear test site. Technical report, 15:49396 (R;US)

NUCLEAR FACILITIES
See also FUEL REPROCESSING PLANTS
NUCLEAR POWER PLANTS
RADIOACTIVE WASTE FACILITIES
Adaptation of high pressure water jets with abrasives for nuclear installations dismantling, 15:48651 (R;FR;In French)
An expert system for automated robotic grasping, 15:49164 (R;US)
An infrared imaging area sensor for tactical and physical security applications, 15:48394 (R;US)
An investigation of the critical facility tritium monitoring, 15:48373 (R;US)
Decontamination and decommissioning facility environmental assessment, Feed Materials Production Center, Fernald, Ohio, 15:48261 (R;US)

NUCLEAR FRAGMENTS
See also FISSION FRAGMENTS
Isotopical separation of relativistic projectile fragments, first experiments at SATURNE, 15:50006 (RA;FR)

NUCLEAR FUEL ELEMENTS
See FUEL ELEMENTS

NUCLEAR FUELS
See also DISPERSION NUCLEAR FUELS
MIXED CARBIDE FUELS
SPENT FUELS
Economics of the use of the Laguna Verde 2 initial core as reloads of Laguna Verde 1, 15:48248 (RA;XA)
Kinetics of recrystallization and fission-gas induced swelling in high burnup UO_2 and U_3Si_2 nuclear fuels, 15:48218 (R;US)

The Neutron Radiography Reactor (NRAD), 15:48620 (R;US)

NUCLEAR MAGNETIC RESONANCE
Electronic origins of NMR parameters, 15:50066 (RA;BR;In Spanish)

NUCLEAR MATERIALS MANAGEMENT
Automatic remote communication system: Development of the upgraded RECOVER system, 15:48392 (R;JP;In Japanese)
Statistical calibration and periodic performance checks for segmented gamma scanning, 15:48393 (R;US)
Validating detection probabilities for the ASSESS [Analytic System and Software for Evaluating Safeguards and Security] insider database, 15:48395 (R;US)

NUCLEAR MATTER
Level density parameter of nuclei at finite temperature, 15:50008 (R;FR)
Towards high-density matter with relativistic heavy-ion collisions, 15:50030 (R;JP)

NUCLEAR MEDICINE
See also RADIOLOGY
Nuclear medicine and imaging research (quantitative studies in radiopharmaceutical science): Progress report, January 1–September 1, 1990, 15:49688 (R;US)
Nuclear medicine and quantitative imaging research (instrumentation and quantitative methods of evaluation): Progress report, January 15–September 1, 1990, 15:49687 (R;US)

NUCLEAR MODELS
See also COLLECTIVE MODEL
QUASIPARTICLE-PHONON MODEL
Axial asymmetry and the IBM, 15:50018 (R;US)

NUCLEAR PHYSICS
Section for nuclear physics and energy physics - Annual report 1989: January 1 - December 31, 1989, 15:50207 (R;NO)

NUCLEAR POWER PLANTS
CORQUENCH: A model for gas sparging-enhanced melt-water, film boiling heat transfer, 15:48644 (R;US)
Contribution of Anticipated Transients Without Scram (ATWS) to core melt at United States nuclear power plants, 15:48647 (R;US)
Crack-arrest behavior in SEN wide plates of low-upper-shelf base metal tested under nonisothermal conditions: WP-2 series, 15:48608 (R;US)
DER 89: main facts, 15:48736 (R;FR;In French)
Development of the Structural Materials Information Center, 15:48646 (R;US)
LQG/LTR control system design for a low-pressure feedwater heater train with time delay, 15:48612 (R;US)
Licensee Event Report (LER) compilation for month of August 1990: Volume 9, No. 8, 15:48592 (R;US)
Overview and comparison of US commercial nuclear power plants: Nuclear power plant system sourcebook, 15:48539 (R;US)
Proceedings of the third International Atomic Energy Agency specialist's meeting on subcritical crack growth: Opening session and Technical session 1, 15:48537 (R;US)
Proceedings of the third International Atomic Energy Agency specialists' meeting on subcritical crack growth: Technical sessions 2, 3, and 4 and Recommendations and conclusions Session 5, 15:48538 (R;US)
Research activities related to nuclear power plant ageing in the Federal Republic of Germany, 15:48525 (RA;XA)
S. 1966: Advanced Nuclear Reactor Research, Development, and Demonstration Act of 1989. Introduced in the Senate of the United States, One Hundredth First Congress, First Session, November 21, 1989, 15:48737 (B;US)
Solidification in cement of ion-exchange resins from LOMI [Low Oxidation State Metal Ion] decontamination: Final report, 15:48269 (R;US)
Summary report on safety objectives in nuclear power plants, 15:48649 (R;FR)
Validating data from instruments in harsh environments: The designer's dilemma, 15:48615 (J;US)

NUCLEAR POWER STATIONS
See NUCLEAR POWER PLANTS

NUCLEAR SAFETY
See RADIATION PROTECTION

NUCLEAR SPIN RESONANCE
See NUCLEAR MAGNETIC RESONANCE

NUCLEAR STRUCTURE
Effects of the residual proton-neutron interaction in the development of collectivity in nuclei, 15:50020 (R;US)
Empirical proton-neutron interaction energies and nuclear structure, 15:50021 (R;US)
Nucleon parton distributions and nuclear structure, 15:49979 (R;US)
Real-pion states formed by virtual-pion beam: New family of nuclear excited states, 15:49996 (R;JP)
The proton-neutron residual interaction in nuclear structure, 15:50019 (R;US)

NUCLEAR SUPERHEATING
Neutron detection based on superheated materials, 15:49355 (J;US)

NUCLEAR TRADE
Communications received from Members regarding the export of nuclear material and of certain categories of equipment and other material: Further communications dated 1 June 1990, 15:48398 (R;XA)
Communications received from Members regarding the export of nuclear material and of certain categories of equipment and other material: A further communication dated 9 May 1990, 15:48397 (R;XA)
Communications received from Members regarding the export of nuclear material and of certain categories of equipment and other material: A further communication dated 8 May 1990, 15:48396 (R;XA)

NUCLEAR WASTES
See RADIOACTIVE WASTES

NUCLEAR WEAPON TESTS
See NUCLEAR EXPLOSIONS

NUCLEAR WEAPONS
Risk of disclosure of sensitive information during warhead dismantlement, 15:48851 (R;US)

NUCLEOGENESIS
See NUCLEOSYNTHESIS

NUCLEON ISOBARS
See N*BARYONS

NUCLEON-NUCLEON INTERACTIONS
A three-dimensional model of separable potential interaction at high energies, 15:49943 (R;UA;In Russian)
Resonating-group method in calculations of low-energy reactions and n^4He scattering with realistic NN interactions, 15:50026 (R;SU;In Russian)
Study of the effects in three-nucleon systems due to the violation of nuclear forces charge independence, 15:49946 (R;UA)

NUCLEONS
See also NEUTRONS
PROTONS
Nucleon parton distributions and nuclear structure, 15:49979 (R;US)

NUCLEOSYNTHESIS
See also THERMONUCLEAR REACTIONS
Nucleosynthesis in the rapid-proton process, 15:50004 (R;JP)

NUCLIDES
See ISOTOPES

O

OAK RIDGE NATIONAL LABORATORY
See ORNL

OAK RIDGE RESEARCH REACTOR
See ORR REACTOR

OCEAN THERMAL ENERGY CONVERSION
Conceptual design of an open-cycle ocean thermal energy conversion net power-producing experiment (OC-OTEC NPPE), 15:48471 (R;US)

OCEAN THERMAL POWER PLANTS
Conceptual design of an open-cycle ocean thermal energy conversion net power-producing experiment (OC-OTEC NPPE), 15:48471 (R;US)
OCEANIC CIRCULATION
Oceanic CO_2 uptake and future atmospheric CO_2 concentrations, 15:49589 (R;US)
OCEANS
See SEAS
ODOCOILEUS
See DEER
OFF-GAS SYSTEMS
Engineering study: Improved facilities for the removal of Iodine-131 from Purex process vent off-gas, 15:48225 (R;US)
OFF-PEAK ENERGY STORAGE
Electric utility benefits of superconducting magnetic energy storage, 15:48497 (R;US)
Thermal energy storage for integrated gasification combined-cycle power plants, 15:48496 (R;US)
OFFSHORE OPERATIONS
Offshore ice problems in the Arctic Sea, 15:49194 (RA;CA)
OFFSHORE PLATFORMS
Analysis of uncertainties in environmental loading on offshore structures, 15:49196 (R;GB)
Effects of cathodic protection potential and stress ratio on fatigue thresholds of structured steels in sea water, 15:48894 (R;GB)
The influence of placement methods on the in-situ density of hydraulic sand fills, 15:49199 (RA;CA)
The loading on offshore structures from breaking waves, 15:49198 (R;GB)
OHMIC PLASMA HEATING
See JOULE HEATING
OIL FIELDS
MCNP capabilities for nuclear well logging calculations, 15:49376 (J;US)
OIL RESIDUES
See PETROLEUM RESIDUES
OIL SAND DEPOSITS
See also ATHABASCA DEPOSIT
Steam circulation in horizontal wellbores, 15:48196 (RA;CA)
OIL SAND INDUSTRY
Alberta oil sands annual statistics, 1987, 15:48204 (R;CA)
How to make money producing heavy oil?, 15:48203 (RA;CA)
OIL SAND MINING
Current reclamation approach at the syncrude oil sands plant, 15:48208 (RA;CA)
OIL SAND PROCESSING PLANTS
Important design considerations for heavy oil plants, 15:48193 (RA;CA)
OIL SAND TAILINGS
Current reclamation approach at the syncrude oil sands plant, 15:48208 (RA;CA)
The effect of freezing and thawing on the dewatering of oil sands sludges, 15:48209 (RA;CA)
OIL SANDS
A new analytical technique for the comprehensive characterization of oil sands: Reflectance spectroscopy, 15:48201 (RA;CA)
Challenges and innovations 1990. Seventh annual heavy oil and oil sands technical symposium, 15:48192 (R;CA)
Fireflood ignition devices and methods, 15:48200 (J;US)
OIL SHALE PROCESSING PLANTS
UNOCAL Parachute Creek Shale Oil Program. Environmental monitoring plan, annual report, October 1, 1988-September 30, 1989, 15:48207 (R;US)
OIL SHALE WASTE WATER
See OIL SHALES
WASTE WATER
OIL SHALES
Determination of flow-regime boundaries for cohesive particles: Quarterly report, December 20, 1989–March 20, 1990, 15:48211 (R;US)
Determination of flow-regime boundaries for cohesive particles: Quarterly report, September 20–December 19, 1989, 15:48210 (R;US)
Testing of New Brunswick oil shale in R.P.C. test facility. Open File Report No. 90-2, 15:48199 (R;CA)
OIL SPILL FINGERPRINTING
See OIL SPILLS
OIL SPILLS
Emergency response notification system, 15:48158 (R;US)
Maritime Pollution Claims Fund (Canada): Annual report 1988-1989, 15:48150 (R;CA)
Maritime Pollution Claims Fund annual report, 1988-1989, 15:48165 (R;CA)
Oil spill preparedness in the upstream petroleum industry, 15:48153 (R;CA)
Oil-spill preparedness in the upstream petroleum industry, 15:48152 (R;CA)
Toxicology of oil-spill cleanup agents. Final report, 15:48161 (R;US)
OIL WELLS
A semianalytical thermal model for linear steamdrive, 15:48135 (BA;US)
Alberta oil and gas industry annual statistics, 1988, 15:48133 (R;CA)
Bacterial evaluation of the biopolymer selective plugging field test at Standard Hill, Saskatchewan, 15:48132 (R;CA)
Chesapeake Resources Ltd. application for a well licence, Whitemud area: Decision 90-3, 15:48168 (R;CA)
Foams for effective gas blockage in the presence of crude oil, 15:48134 (BA;US)
OKLAHOMA
Evaluation of unrecovered mobile oil in Texas, Oklahoma, and New Mexico, 15:48136 (BA;US)
OMEGA-1778 RESONANCES
See MESONS
ON-LINE COMPUTERS
See COMPUTERS
ON-LINE CONTROL SYSTEMS
Distributed computer system based on local area network ALISA in experimental investigations, 15:50217 (R;SU;In Russian)
Local facility control organization in distributed automated control systems of technological parameters, 15:48610 (R;SU;In Russian)
ON-LINE MEASUREMENT SYSTEMS
A proposed scalable parallel open architecture data acquisition system for low to high rate experiments, test beams and all SSC detectors, 15:49274 (J;US)
Experimental set-up for investigation of high-energy electrons scattering and radiation during their channeling in monocrystals, 15:49245 (R;SU;In Russian)
ONTARIO
A study of Ontario Hydro's contribution to ozone levels in Ontario: Phase 1: Literature review, 15:48450 (R;CA)
Canada Brick Quarry Ground Water Survey 8th annual report, 1988-1989, 15:49605 (R;CA)
Costs of alternate strategies for reducing nitrogen oxide and volatile organic compounds. Emissions from stationary sources in Ontario, 15:49470 (RA;CA)
Measurement of biogenic and anthropogenic volatile organic compounds during the Canadian atmospheric chemistry study, July 17 to August 31, 1988, 15:49466 (R;CA)
Measurement of biogenic and anthropogenic volatile organic compounds during the Canadian Atmospheric Study, July 17 to August 31, 1988, 15:49472 (R;CA)
OPEN-CYCLE SYSTEMS
Conceptual design of an open-cycle ocean thermal energy conversion net power-producing experiment (OC-OTEC NPPE), 15:48471 (R;US)
OPTICAL EQUIPMENT
Integrated optical modulators for analog signal transmission, 15:49380 (R;US)
OPTICAL SYSTEMS
Influence of 14-MeV neutrons and gamma radiation on optical fibers and optoelectronic devices, 15:49366 (RA;CS)
Optical data transmission at the superconducting super collider, 15:49368 (J;US)

Trip report: International Congress on Applications of Lasers and Electro-Optics, Oct. 16-19, 1989, Orlando, Florida, 15:48895 (R;CA)

ORE PROCESSING
A study on the recovery of uranium from low grade vein deposits, 15:48254 (RA;XA)
Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988, 15:48242 (R;XA)
Spanish yellow cake production by bioleaching, 15:48214 (RA;XA)

ORES
Iowa State Mining and Mineral Resources Research Institute: Semi-annual report, July 1, 1989–December 31, 1989, 15:49738 (R;US)

ORGANIC CHLORINE COMPOUNDS
See also CHLORINATED ALIPHATIC HYDROCARBONS
CHLORINATED AROMATIC HYDROCARBONS
NEOPRENE
Final best demonstrated available technology (BDAT) background document addendum for K015. Volume 4, 15:49478 (R;US)
Final response to BDAT related comments document. F025, K002-K008, K011, K013-15, K046, K061, K069. volume 1-k, 15:49526 (R;US)

ORGANIC COMPOUNDS
See also ESTERS
HYDROCARBONS
ORGANIC HALOGEN COMPOUNDS
ORGANIC NITROGEN COMPOUNDS
ORGANIC PHOSPHORUS COMPOUNDS
ORGANIC POLYMERS
ORGANIC SULFUR COMPOUNDS
ORGANOMETALLIC COMPOUNDS
PROTEINS
Amendment to the final best demonstrated available technology (BDAT) background document for distillation bottom tars from the production of phenol/acetone from cumene K022. Final report, 15:49506 (R;US)
Best demonstrated available technology (BDAT) background document for U and P wastes and multi-source leachate (F039). Volume C. Nonwastewater forms of organic U and P wastes and multi-source leachate (F039) for which there are concentration-based treatment standards. Final report, 15:49505 (R;US)
Best demonstrated available technology (BDAT) background document for U and P wastes and multi-source leachate (F039). Volume B. U and P wastewaters and nonwaste waters with methods of treatment as treatment standards. Final report, 15:49504 (R;US)
Final best demonstrated available technology (BDAT) background document for K021. Volume 6, 15:49480 (R;US)
Final best demonstrated available technology (BDAT) background document for K060. Volume 8, 15:49482 (R;US)
Health assessment for Waste Engineering, Inc., Sanitary Landfill, Andover, Minnesota, Region 5. CERCLIS No. NMD9806091192 (amended). Final report, 15:49632 (R;US)
Measurement of biogenic and anthropogenic volatile organic compounds during the Canadian atmospheric chemistry study, July 17 to August 31, 1988, 15:49466 (R;CA)
Measurements of exhaled breath using a new portable sampling method, 15:49538 (R;US)
Organic chemistry of mantle-derived xenoliths: Assessing the possibilities for deep sources of natural gas. Biennial report, November 1987-November 1989, 15:48179 (R;US)
Pollution load on the gulf of Finland in 1982-1984, 15:49636 (R;FI)
Reactor processes in synthetic organic chemical manufacturing industry. background information for proposed standards. Draft report, 15:49540 (R;US)

ORGANIC FLUORINE COMPOUNDS
See also FLUORINATED ALIPHATIC HYDROCARBONS
Method of measuring Cf_3T activity developed for laser-based tritium separation, 15:48399 (R;CA)
Reaction of $(Me_5C_5)_2Yb$ with fluorocarbons: Formation of $(Me_5C_5)_4Yb_2(\mu\text{-}F)$ by intermolecular C-F activation, 15:49017 (RA;US)

ORGANIC HALOGEN COMPOUNDS
See also HALOGENATED ALIPHATIC HYDROCARBONS
ORGANIC CHLORINE COMPOUNDS
ORGANIC FLUORINE COMPOUNDS
Final response to BDAT related comments document. Halogenated organic wastes. Volume 1-N, 15:49528 (R;US)

ORGANIC NITROGEN COMPOUNDS
See also NITRO COMPOUNDS
PORPHYRINS
Final response to BDAT related comments document. Halogenated organic wastes. Volume 1-N, 15:49528 (R;US)
Proton and anion binding properties of an OCTA-Aza cryptand, 15:49090 (BA;US)
Work in progress (Synthesis and examination of graphite-structure type compounds), 15:49106 (RA;US)

ORGANIC PHOSPHORUS COMPOUNDS
Amendment to best demonstrated available technology (BDAT) background document for K037. Final report, 15:49511 (R;US)

ORGANIC POLYMERS
See also NEOPRENE
POLYOLEFINS
POLYVINYLS
RESINS
THERMOPLASTICS
Controllable changes in the porous structure of polymeric nuclear membranes, 15:48958 (R;SU)

ORGANIC SOLVENTS
Final best demonstrated available technology (BDAT) background document addendum for F002 (1,1,2-trichloroethane) and F005 (benzene, 2-ethoxyethanol, and 2-nitropropane). Volume 16, 15:49490 (R;US)

ORGANIC SULFUR COMPOUNDS
See also SULFONIC ACIDS
THIOLS
Electrochemical investigations of organodisulfide/thiolate redox couples, 15:49113 (RA;US)
Final response to BDAT related comments document. Halogenated organic wastes. Volume 1-N, 15:49528 (R;US)

ORGANOMETALLIC COMPOUNDS
$(Me_5C_5)_2Yb(\mu\text{-}H_3B)(PMe_3)$: A complex with a near-linear BH_3 bridging group, 15:49016 (RA;US)
Models for organometallic polymers: Zigzag chains of $Mo_2(O_2CCH_3)_4$ units linked by dimethylphospinoethane (dmpe) and tetramethylethylenediamine (tmeda) ligands, 15:49055 (RA;US)
Potentially catalytic and conducting polyorganometallics, 15:49052 (RA;US)
Readily-accessible oxidation of d^0 organozirconium compounds: The electronic structure of $(\eta^5\text{-}C_5H_5)_3ZrX$ compounds, 15:49028 (BA;US)
The electronic structure of organometallic complexes of the f elements - XXIII. Interpretation of the magnetochemical and optical data of a tetrahydrofuran adduct derived from tris(η^5 cyclopentadienyl)-ytterbium(III), 15:49064 (RA;US)
Work in progress, 15:49128 (RA;US)

ORNL
Isotope geochemistry: A critical component of energy research, 15:49739 (R;US)

ORNL RESEARCH REACTOR
See ORR REACTOR

ORR REACTOR
The ORR Whole-Core LEU Fuel Demonstration: Final report, 15:48609 (R;US)

OSCILLATIONS (PLASMA)
See PLASMA WAVES

OSMIUM FLUORIDES
A general method for the synthesis of polymeric binary fluorides exemplified by AgF_3, NiF_4, RuF_4, and OsF_4, 15:49099 (RA;US)

OSMIUM ISOTOPES
Shape isomers at no spin, 15:50013 (R;FR)

OTEC
See OCEAN THERMAL ENERGY CONVERSION
OUTPUT
See PRODUCTION
OXETANE
See ETHERS
OXIDANTS
See OXIDIZERS
OXIDASES
See OXIDOREDUCTASES
OXIDES
See also ALUMINIUM OXIDES
ANTIMONY OXIDES
BARIUM OXIDES
BISMUTH OXIDES
CALCIUM OXIDES
CERIUM OXIDES
CHROMIUM OXIDES
COBALT OXIDES
COPPER OXIDES
DYSPROSIUM OXIDES
HOLMIUM OXIDES
LANTHANUM OXIDES
MAGNESIUM OXIDES
MOLYBDENUM OXIDES
NICKEL OXIDES
NITROGEN OXIDES
POTASSIUM OXIDES
RUTHENIUM OXIDES
SILICON OXIDES
STRONTIUM OXIDES
SULFUR OXIDES
THALLIUM OXIDES
THORIUM OXIDES
TITANIUM OXIDES
TUNGSTEN OXIDES
VANADIUM OXIDES
YTTRIUM OXIDES
ZINC OXIDES
ZIRCONIUM OXIDES
Investigations of defined oxides for improving the determination of emissivity of high temperatures. Pt. 1 and 2. Pt. 1: Determination of emissivity and optical constants. - Pt. 2: Preparation and analysis of probes, 15:48874 (R;DE;In German)
Surface phases and their influence on metal-oxide interfaces: [Progress report], 15:48869 (R;US)
OXIDIZERS
Atmospheric fates of air pollutants, 15:49551 (RA;FI)
OXIDIZING AGENTS
See OXIDIZERS
OXIDOREDUCTASES
Nitrate reductase is induced in red spruce by NO_2 and HNO_3 vapor, 15:49726 (J;US)
OXYGEN
In-situ transmission electron microscopy and computer simulation study of the kinetics of oxygen loss in $YBa_2Cu_3O_z$, 15:48932 (R;US)
Updated excitation and ionization cross sections for electron impact on atomic oxygen. Quarterly report, 15:49891 (R;US)
OXYGEN 22
Beta decay of ^{22}O, 15:50002 (R;FR)
OXYGEN EFFECT (RADIOBIOLOGY)
See OXYGEN
OXYGEN HYDRIDES
See WATER
OXYGEN ISOTOPES
See also OXYGEN 22
Investigation of the particle stability of the isotope ^{26}O in the nuclear reactions 44 MeV/A ^{48}Ca+Ta, 15:50005 (RA;SU)
OXYGEN LOGS
See NEUTRON-GAMMA LOGGING
OXYMETHYLENE
See FORMALDEHYDE
OZONE
A study of Ontario Hydro's contribution to ozone levels in Ontario: Phase 1: Literature review, 15:48450 (R;CA)
Acid air pollutant mixtures: Respiratory system responses and effects of exercise, 15:49720 (R;US)

P

P CODES
Multi-dimensional modeling of unsaturated flow in the vicinity of exploration shafts and fault zones at Yucca Mountain, Nevada, 15:48347 (BA;US)
Software for the ODRA and ODRENOK computers; programs for text file processing, 15:50220 (R;SU;In Russian)
PACIFIC NORTHWEST LABORATORIES
See BATTELLE PACIFIC NORTHWEST LABORATORIES
PACIFIC NORTHWEST REGION
See FEDERAL REGION X
PACIFIC OCEAN
Report on the preparatory investigation of the Pacific energy information network system, 15:48741 (R;JP;In Japanese)
PACKAGING
Development of hermetic microminiature connectors, 15:49217 (R;US)
PAH
See POLYCYCLIC AROMATIC HYDROCARBONS
PALLADIUM
Analysis of the published calorimetric evidence for electrochemical fusion of deuterium in palladium. Technical report, 15:50108 (R;US)
Cold fusion in palladium: the experimental results from PSI, 15:50197 (RA;GB)
PAPER CHROMATOGRAPHY
See CHROMATOGRAPHY
PAPER INDUSTRY
Daishowa Canada Ltd., Peace River pulp mill industrial development permit to use gas as a supplementary fuel: Decision 90-7, 15:48185 (R;CA)
Non-waste technology - a challenge to biotechnology, 15:48827 (RA;FI)
PARAGENES
See PLASMIDS
PARALLEL PROCESSING
Language support for parallel computation. Final report, September 1988-September 1989, 15:50211 (R;US)
Parallel performance models for the nodal transport method on the hypercube, 15:50213 (R;US)
Superconcurrent processing: A dynamic approach to heterogeneous parallelism. Final report, 15:50210 (R;US)
Use of fiber-optics for real-time control and data acquisition, 15:49270 (J;US)
PARAMAGNETIC RESONANCE (NUCLEAR)
See NUCLEAR MAGNETIC RESONANCE
PARTICLE IDENTIFICATION
Particle identification in B-physics, 15:49311 (RA;JP;In Japanese)
PARTICLE PRODUCTION
See also ELECTROPRODUCTION
Charged pion production in nucleus-nucleus collisions at E/A between 400 and 800 mev, 15:50007 (R;FR;In French)
PARTICLES
See also DROPLETS
INTERSTELLAR GRAINS
PARTICULATES
Deposition, corrosion, erosion and sulfur emission studies related to coal combustion: Annual report, 15:48109 (R;US)
Fabric filters: Filtermedia, 15:49553 (RA;FI)
Optical measuring methods, 15:49554 (RA;FI)
Particle formation in combustion, 15:49552 (RA;FI)
Size distribution measurement of particles in flue gases, 15:49550 (RA;FI)
The theory and technics of particle measuring methods: Controlling measurements. Dust, 15:49556 (RA;FI)

PARTICULATES
Deposition of airborne particles from fractured spent fuel or high-level waste, 15:48374 (BA;US)
Determination of the levels of dinitropyrenes on diesel-exhaust particulate exhibiting excess mutagenic activity, 15:48123 (R;CA)
Inhalation toxicology of combined acid and soot particles. Final report, 15:49719 (R;US)
Mechanisms of surface enrichment and adhesion of coal combustion particulates: Eighth and ninth quarterly reports, June 16, 1988–December 15, 1988, 15:48113 (R;US)
Mechanisms of surface enrichment and adhesion of coal combustion particulates: Sixth and seventh quarterly reports, December 16, 1987–June 15, 1988, 15:48112 (R;US)
The determination of the levels of dinitropyrenes on diesel exhaust particulate exhibiting excess mutagenic activity: Final report, 15:48841 (R;CA)

PARTITION CHROMATOGRAPHY
See CHROMATOGRAPHY

PASSIVE SOLAR HEATING SYSTEMS
A passive solar heating facility for existing houses: Demonstration project: Final report, 15:48473 (R;LU)

PCB
See CHLORINATED AROMATIC HYDROCARBONS

PEACH BOTTOM-2 REACTOR
Radionuclide release calculations for selected severe accident scenarios: Supplemental calculations, 15:48663 (R;US)

PEAKING POWER PLANTS
Draft guidelines for an environmental impact assessment: N.B. Power, Millbank Generating Station, 15:48151 (R;CA)

PEANUTS
Handling and curing peanuts in modified tobacco bins, 15:48822 (R;CA)

PELLETS (FUEL)
See FUEL PELLETS

PENETRATORS
Tethered rocket as a vehicle for penetration and impact testing: Development report, 15:49393 (R;US)

PENNSYLVANIA
Health assessment for Elizabethtown Landfill, Elizabethtown, Lancaster County, Pennsylvania, Region 3. CERCLIS No. PAD980539712. Final report, 15:49614 (R;US)
Health assessment for Occidental Chemical Corporation Site, Lower Pottsgrove Township, Montgomery County, Pennsylvania, Region 3. CERCLIS No. PAD980229298. Preliminary report, 15:49623 (R;US)
Health assessment for Recticon/Allied Steel Corporation, Parkerford, Chester County, Pennsylvania, Region 3. CERCLIS No. PAD053302865. Preliminary report, 15:49533 (R;US)
Superfund Record of Decision (EPA Region 3): Westline, PA. (First remedial action) (amendment), March 1990, 15:49630 (R;US)

PENTADIENES
On the way to ligating oligocyclopentadienyls: Synthesis and preliminary reactivity of the two isomeric tercyclopentadienyls and their transition-metal complexes, 15:49053 (RA;US)

PEOPLE
See HUMAN POPULATIONS

PERMANENT MAGNETS
Metallurgical processes in multi-component rare earth-transition metal permanent magnet alloys. Final report, 15 May 1987-14 May 1990, 15:48854 (R;US)

PERMEABILITY COEFFICIENT (FLUID MECHANICS)
See HYDRAULIC CONDUCTIVITY

PERSONNEL DOSIMETRY
Examples of robots and teleoperators at the Savannah River Site, 15:49175 (J;US)
Neutron detection based on superheated materials, 15:49355 (J;US)
X-ray spectrometry in vivo a Si(Li)-NaI(T1) detector, 15:49352 (J;US)

PERSONNEL FILM DOSIMETRY
See PERSONNEL DOSIMETRY

PETROCHEMISTRY
Vanadyl model compounds in size exclusion-inductively coupled plasma-atomic emission (SEC-ICP-AES) studies of metal complexes in heavy crude oils and residua, 15:48175 (BA;US)
X-ray absorption spectroscopic study of vanadium sites in fossil fuels and model compounds, 15:48090 (BA;US)

PETROLEUM
Biodegradation
Use of Office of Research and Development's bioremediation expertise in Superfund removal program. Directive (Final), 15:48159 (R;US)
Compatibility
Study of asphaltene flocculation in heavy oil and asphalt solutions, 15:48173 (R;CA)
Continental Shelf
An econometric analysis of exploration and extraction of oil on the U.K. continental shelf, 15:48142 (R;GB)
Coprocessing
Stable carbon isotope analysis of coprocessing materials: Quarterly technical progress report, July 1–September 30, 1989, 15:48076 (R;US)
Demulsification
The CANMET [Canada Centre for Mineral and Energy Technology] emulsion upgrading process, 15:48195 (RA;CA)
Econometrics
An econometric analysis of exploration and extraction of oil on the U.K. continental shelf, 15:48142 (R;GB)
Energy Source Development
A handbook for management of oil and gas activities on lands in Alaska: Petroleum industry practices, environmental impacts and stipulations, 15:48149 (R;US)
Energy Substitution
Survey for impacts of global environmental issues on utilizations of alternative energies for oil, 15:49469 (R;JP;In Japanese)
Exploration
An econometric analysis of exploration and extraction of oil on the U.K. continental shelf, 15:48142 (R;GB)
Extraction
An econometric analysis of exploration and extraction of oil on the U.K. continental shelf, 15:48142 (R;GB)
Hydraulic Transport
Effects of produced sand on short distance pipeline transportation of heavy oil in water emulsions: SRC [Saskatchewan Research Council] pipeloop test results: Final report, 15:48172 (R;CA)
Hydrogenation
The CANMET [Canada Centre for Mineral and Energy Technology] emulsion upgrading process, 15:48195 (RA;CA)
Maritime Transport
Potential issues associated with shipping oil and gas through the Labrador Sea and Strait of Belle Isle, 15:48170 (R;CA)
Response to recommendation No. 80, Beaufort Sea environmental assessment and review panel: Final report, 1984-89, 15:48171 (R;CA)
Market
World oil market projections, 1990-2005. Study No. 34, 15:48141 (R;CA)
Meetings
Challenges and innovations 1990. Seventh annual heavy oil and oil sands technical symposium, 15:48192 (R;CA)
Prices
World oil market projections, 1990-2005, 15:48139 (R;CA)
Recovery
Gulf of Mexico sales 131, 135, and 137: Central, Western, and Eastern planning areas: Final environmental impact statement: Volume 2, Sections IV.D. and IX, 15:48154 (R;US)
Reserves
Alberta's reserves of crude oil, oil sands, gas, natural gas liquids, and sulphur, 15:48131 (R;CA)
US oil and gas reserves by year of field discovery, 15:48125 (R;US)
Standards
Amendment to the best demonstrated available technology (BDAT) background document for wastes from the petroleum

refining industry K048, K049, K050, K051, K052. Final report, 15:48146 (R;US)
Final response to BDAT related comments document. K043-K052, K036, K037. Volume 1-O, 15:48147 (R;US)

Supply and Demand
Alberta oil and gas industry annual statistics, 1988, 15:48133 (R;CA)
Outlook for demand growth in Asian countries, 15:48698 (RA;CA)
World oil market projections, 1990-2005, 15:48139 (R;CA)

United Kingdom
An econometric analysis of exploration and extraction of oil on the U.K. continental shelf, 15:48142 (R;GB)

Water Pollution Control
Delegations of authority under the Federal Water Pollution Control Act (FWPCA) which are applicable to the Superfund program. Directive (Final), 15:48157 (R;US)

PETROLEUM COKE
See PETROLEUM PRODUCTS

PETROLEUM DEPOSITS
See also OIL FIELDS
Evaluation of unrecovered mobile oil in Texas, Oklahoma, and New Mexico, 15:48136 (BA;US)
Geologic interpretation of gravity anomalies, 15:48124 (R;US)
Geology of the Stoney Creek oil and gas field, and its implications regarding the tectonic evolution of the eastern Moncton subbasin, New Brunswick. Geoscience report No. 89-1, 15:48130 (R;CA)
Response to recommendation No. 80, Beaufort Sea environmental assessment and review panel: Final report, 1984-89, 15:48171 (R;CA)

PETROLEUM INDUSTRY
Environmental Studies Research Funds annual report, 1989, 15:48747 (R;CA)
Oil-spill preparedness in the upstream petroleum industry, 15:48152 (R;CA)

PETROLEUM PRODUCTS
See also GASOLINE
LIQUEFIED PETROLEUM GASES
LUBRICATING OILS
UNFINISHED OILS
An overview of hydrodesulfurization (HDS), hydrodenitrification (HDN), and hydrodemetalation (HDM) in petroleum chemistry, 15:48138 (BA;US)

PETROLEUM REFINERIES
Amendment to the best demonstrated available technology (BDAT) background document for wastes from the petroleum refining industry K048, K049, K050, K051, K052. Final report, 15:48146 (R;US)
Assessment of the organics containment plume at Ville-Mercier, Quebec, Canada, 15:49586 (RA;CA)
Catalytic hydrotreatment of refinery waste: Demonstration project: Final report, 15:48145 (R;LU)
Final response to BDAT related comments document. K043-K052, K036, K037. Volume 1-O, 15:48147 (R;US)

PETROLEUM RESIDUES
Exploratory coprocessing research: Quarterly report No. 7, March 1, 1990–May 31, 1990, 15:48077 (R;US)
Recent developments in donor solvent upgrading (DRB), 15:48198 (RA;CA)

PETT
See POSITRON COMPUTED TOMOGRAPHY

PETTEN HIGH FLUX REACTOR
See HFR REACTOR

PH VALUE
Determination of the acid level of weakly mineralized waters, 15:49634 (R;CA)

PHAEDRUS MIRROR DEVICES
Variable eigenmode excitation in the beach heating of two-ion-species mirror plasmas, 15:50120 (R;US)

PHAGES
See BACTERIOPHAGES

PHANTOMS
3-D phantom to simulate cerebral blood flow and metabolic images for PET, 15:49701 (J;US)
A high-resolution SPECT system based on a microchannel-plate imager, 15:49346 (J;US)
A phantom for quality control in mammography, 15:49677 (RA;GB)
Application of mathematical removal of positron range blurring in positron emission tomography, 15:49360 (J;US)
Measuring PET scanner sensitivity: Relating count rates to image signal-to-noise ratios using noise equivalent counts, 15:49350 (J;US)
Patient equivalent phantoms in chest radiography, 15:49674 (RA;GB)

PHASE STUDIES
High-pressure phase equilibria in hydrocarbon-water (brine) systems, 15:48491 (RA;US)

PHASEOLUS
Mild water stress effects on carbon-reduction-cycle intermediates, ribulose bisphosphate carboxylase activity, and spatial homogeneity of photosynthesis in intact leaves, 15:48465 (J;US)

PHENOL
Anaerobic fluid-bed treatment of coal conversion wastewater: Tenth quarterly technical progress report, November 15, 1988–February 15, 1988, 15:48093 (R;US)

PHENOLS
See also CRESOLS
PHENOL
Prediction of the environmental fate of pentachlorophenol as a function of pH using fugacity models, 15:49573 (R;CA)

PHENYLAMINE
See ANILINE

PHI4-FIELD THEORY
Quantum corrections to kink-type classical solution in one-dimensional phi 4 model, 15:49976 (RA;SU;In Russian)

PHONONS
Surface anharmonicity: Temperature dependence of phonon energies on Cu(110), 15:50068 (R;US)

PHOSPHATE GLASS
Raman spectra of molybdenum phosphate glasses and some crystalline analogues, 15:48946 (J;US)

PHOSPHORS
See also LIQUID SCINTILLATORS
PLASTIC SCINTILLATORS
A more rugged ZnS(Ag) alpha scintillation detector, 15:49564 (J;US)

PHOSPHORUS
Pollution load on the gulf of Finland in 1982-1984, 15:49636 (R;FI)

PHOTOCHEMISTRY
Light induced processes of MLCT [metal to ligand charge transfer] excited states attached to a soluble polymer, 15:49143 (BA;US)

PHOTOCHROMIC MATERIALS
Light induced processes of MLCT [metal to ligand charge transfer] excited states attached to a soluble polymer, 15:49143 (BA;US)

PHOTOELECTRON COUNTING
Experimental study of the single electron response of the DELPHI Barrel RICH MWPC's, 15:49287 (R;FR)

PHOTOGRAPHIC FILM DETECTORS
Photoemulsion vertex detector at the SKIF installation, 15:49304 (R;SU;In Russian)

PHOTOMAGNETOELECTRIC EFFECT
See MAGNETIC FIELDS

PHOTON COLLISIONS
The physics of electronic and atomic collisions, 15:49868 (B;US)

PHOTON DETECTION (GAMMA)
See GAMMA DETECTION

PHOTON DETECTION (X-RAY)
See X-RAY DETECTION

PHOTON TRANSPORT
Monte Carlo next-event estimates from thermal collisions, 15:50060 (R;US)

PHOTON-PROTON INTERACTIONS
Excited quark production at ep and γp colliders, 15:49933 (R;SU)

PHOTOVOLTAIC CELLS
Calibration of photovoltaic cells and modules used for terrestrial applications, 15:48457 (R;FR;In French)
Efficient photovoltaic devices for InP semiconductor/liquid junctions. Technical report, 15:48454 (R;US)
Field trial procedure to assess the behavior of photovoltaic modules under natural condition, 15:48458 (R;FR)
Resistance of solar modules to environment constraints, 15:48456 (R;FR;In French)
Solar energy photovoltaic conversion 1982-1985 research review, 15:48455 (R;FR;In French)
Structure of amorphous-silicon and germanium alloy films: Annual subcontract report, January 15, 1989–January 14, 1990, 15:48463 (R;US)

PHOTOVOLTAIC POWER PLANTS
Terrestrial nickel/hydrogen battery evaluation, 15:48468 (R;US)

PHOTOVOLTAIC POWER SUPPLIES
Diode laser satellite systems for beamed power transmission, 15:48467 (R;US)
Interchange of researchers on alternative energy of petroleum in EC countries, 15:48732 (R;JP;In Japanese)
Study of photovoltaic sites in the Alpes-de-Haute-Provence, 15:48466 (R;FR;In French)

PHYSICAL CHEMISTRY
Nuclear Technology Programs semiannual progress report, October 1987–March 1988, 15:48729 (R;US)

PHYSICS
See also ATOMIC PHYSICS
HIGH ENERGY PHYSICS
NUCLEAR PHYSICS
SOLID STATE PHYSICS
The scalable coherent interface, IEEE P1596: Status and possible applications to data acquisition and physics, 15:49334 (J;US)

PHYTOCHROMES
Mechanism for the selective conjugation of ubiquitin to phytochrome: Progress report for 1989, 15:49643 (R;US)

PI-1016 RESONANCES
See MESONS

PIGE ANALYSIS
See PROMPT GAMMA RADIATION
PROTON REACTIONS

PILES
See FOUNDATIONS

PINS (FUEL)
See FUEL PINS

PION PLUS REACTIONS
Study on the $\pi^+ \rightarrow \eta$ and $\pi^+ \rightarrow \pi^0\pi^0$ exclusive processes on nuclei at 10.5 GeV/c, 15:49910 (R;SU;In Russian)

PIONIC ATOMS
Capture and transfer of pions in hydrogenous materials, 15:49894 (R;CA)

PIONS
See also PIONS MINUS
PIONS PLUS
Capture and transfer of pions in hydrogenous materials, 15:49894 (R;CA)
Perspectives of experimental study of electromagnetic form factors of unstable particles at UNK, 15:49911 (R;SU;In Russian)

PIONS MINUS
Charged pion production in nucleus-nucleus collisions AT E/A between 400 and 800 MeV, 15:49982 (R;FR;In French)

PIONS PLUS
Charged pion production in nucleus-nucleus collisions AT E/A between 400 and 800 MeV, 15:49982 (R;FR;In French)
Investigation of anomalous pion production in the reaction Cu(p,π^+)X by 350 MeV protons, 15:50010 (RA;SU)
Pion electroproduction near threshold on protons: how reaching the axial form factor of nucleon. Preparatory study of the experiment and pion spectrometer realization, 15:49906 (R;FR;In French)

PIPELINES
Oil pipeline performance review, 1986, 15:48169 (R;CA)

PIPES
BWR [Boiling Water Reactor] Owners Group Intergranular Stress Corrosion Cracking Research Program: Executive summary: Phase 2 (1984–1988): Final report, 15:48528 (R;US)
Development of buried cable location survey system by underground rader for power distribution cables under pavements, 15:48673 (R;JP;In Japanese)
Pressure history of a gas pipeline, 15:48189 (R;CA)

PISTONS
Materials for enhanced heavy fuel capability marine diesels, 15:48931 (RA;US)

PLANETARY ATMOSPHERES
IR spectroscopy of planets and satellites; Venus, Mars, giant planets and titan, 15:49751 (RA;FR)

PLANETARY NEBULAE
Dust in planetary nebulae: IRSPEC observations in the 3.0 μm - 3.8 μm range, 15:49786 (RA;FR)
Planetary nebulae, 15:49777 (RA;FR)

PLANT CULTIVATION
See CULTIVATION TECHNIQUES

PLANTS
Ecological characterization atlas of coastal Alabama: Map narrative, 15:49571 (R;US)
Texas Barrier Islands Region ecological characterization atlas: Biological resources narrative, 15:49570 (R;US)

PLANTS (INDUSTRIAL)
See INDUSTRIAL PLANTS

PLANTS (POWER)
See POWER PLANTS

PLASMA
See also COLLISIONAL PLASMA
EQUILIBRIUM PLASMA
HOT PLASMA
INHOMOGENEOUS PLASMA
LASER-PRODUCED PLASMA
Conditions for ion reflection in a large-amplitude magnetosonic wave, 15:50165 (R;JP)
Electromagnetic wave incoherent reflection by a plasma layer, 15:50153 (R;UA;In Russian)
Particle simulation of a two-dimensional electrostatic plasma, 15:50109 (R;IN)

PLASMA (QUARK)
See QUARK MATTER

PLASMA ACCELERATION
High-energy protons produced by a large-amplitude magnetosonic wave and associated gamma radiation through neutral pion decay, 15:49825 (R;JP)

PLASMA DIAGNOSTICS
Alpha Detection
Some problems of plasma diagnostics in an experimental thermonuclear reactor, 15:50145 (RA;CS;In Russian)
Atomic Beams
A 40 keV neutral lithium beam source for tokamak CASTOR, 15:49876 (RA;CS)
Data Acquisition Systems
Diagnostic system CAE T-15 and prospects of its development, 15:50136 (RA;CS;In Russian)
Data Processing
Methods of superchronous processing of signals in high-temperature plasma diagnostics, 15:50127 (R;SU;In Russian)
Doppler Broadening
Charge-exchange spectroscopy in the T-15 tokamak, 15:50141 (RA;CS;In Russian)
Emission Spectroscopy
Automated system of visible and ultraviolet spectroscopy for the T-15 tokamak, 15:50142 (RA;CS;In Russian)
Energy Levels
Satellite lines of neon-like resonance lines for 17<Z<48, 15:50110 (R;FR)
Fluorescence Spectroscopy
Diagnostics of impurity and neutral components of tokamak plasma by the resonance fluorescence method, 15:50130 (R;SU;In Russian)

Jippt-2 Device
Plasma diagnostics and atomic processes, 15:50162 (R;JP)
Langmuir Probe
A method for determination of the electron temperature from Langmuir probe data in a tokamak edge plasma, 15:50149 (RA;CS)
Investigation of edge plasma by means of Langmuir probes, 15:50148 (RA;CS;In Russian)
Neutron Spectrometers
Neutron spectrometers for the T-15 tokamak, 15:49302 (RA;CS;In Russian)
Plasma Scrape-Off Layer
Thomson scattering equipment for investigation of plasma filament scrape-off layer at the T-10 tokamak, 15:50126 (R;SU;In Russian)
Surface Barrier Detectors
Project of CFP plasma diagnostic system for the T-15 tokamak, 15:50144 (RA;CS;In Russian)
T-15 Tokamak
Technological start of T-15 tokamak. The start-up diagnostic complex, 15:50134 (RA;CS;In Russian)
Tftr Tokamak
Plasma diagnostics and atomic processes, 15:50162 (R;JP)
Thermonuclear Reactions
Diagnostics of a thermonuclear plasma, based on the use of nuclear reactions, 15:50146 (RA;CS;In Russian)
Thomson Scattering
Thomson scattering equipment for investigation of plasma filament scrape-off layer at the T-10 tokamak, 15:50126 (R;SU;In Russian)
Time-Of-Flight Method
A time-of-flight analyzer of low energy atoms (preliminary test on the CASTOR tokamak), 15:50143 (RA;CS)
Tokamak Devices
Methods of superchronous processing of signals in high-temperature plasma diagnostics, 15:50127 (R;SU;In Russian)
X-Ray Spectroscopy
Satellite lines of neon-like resonance lines for $17<Z<48$, 15:50110 (R;FR)
PLASMA FILAMENT
Equilibrium of plasma filament with inhomogeneous field along on axis and without of longitudinal current, 15:50129 (R;SU;In Russian)
PLASMA FOCUS DEVICES
Experimental study of the plasma-focus device as a charged-particle accelerator. Final report, October 1982-May 1985, 15:49223 (R;US)
PLASMA JETS
Gas jet magnetic compression dynamics, 15:50124 (R;SU;In Russian)
PLASMA OSCILLATIONS
See PLASMA WAVES
PLASMA SCRAPE-OFF LAYER
Effect of confinement of SoL plasma on core temperature profile, 15:50161 (R;JP)
PLASMA SIMULATION
Particle simulation of a two-dimensional electrostatic plasma, 15:50109 (R;IN)
PLASMA WAVES
Convergence of numerical schemes suitable for two dimensional nonlinear convection: application to the coupling of modes in a plasma, 15:50092 (R;FR;In French)
Parametric instabilities of electromagnetic waves in layer of plasma-molecular medium, 15:50152 (R;UA;In Russian)
PLASMASPHERE
Remote sensing of the thermosphere, plasmasphere, and exosphere, 15:49361 (J;US)
PLASMIDS
Isolation and properties of plasmids from Deinococcus radiodurans Sark, 15:49714 (R;JP)
PLASTIC SCINTILLATORS
A large-area, scintillation telescope for heavy ions, 15:49328 (J;US)
Studies in the radiation resistance of plastic scintillators: Review and prospects, 15:49373 (J;US)
PLATING SOLUTIONS
See PROCESS SOLUTIONS
PLATINUM
Corrosion and arc erosion in MHD channels: Quarterly progress report, January–March 1990, 15:48757 (R;US)
Structure of Au and Pt films on Pd(110): Deposition temperature and coverage dependent (1 times 2) and (1 times 3) reconstructions, 15:48878 (R;US)
PLATINUM ISOTOPES
Shape isomers at no spin, 15:50013 (R;FR)
PLESIOTHERAPY
See RADIOTHERAPY
PLUGGING AGENTS
Foams for effective gas blockage in the presence of crude oil, 15:48134 (BA;US)
PLUTONIUM
New method permits the detection of alpha emitters at a distance, 15:49563 (J;US)
Robotic requirements for plutonium handling automation, 15:49176 (J;US)
The chemistry of plutonium(VI) in aqueous carbonate solutions, 15:49033 (R;US)
PLUTONIUM 236
Detection of the radioactive decay of ^{236}Pu involving the emission of ^{28}Mg nuclei, 15:50017 (RA;SU;In Russian)
PLUTONIUM 238
Collective bands in actinide nuclei and rare-earth elements in the SU(3) scheme, 15:50025 (R;SU;In Russian)
PLUTONIUM 239
Reprocessing input data validation, 15:48388 (R;US)
US Mussel Watch Program: Transuranic element data from Woods Hole Oceanographic Institution 1976-1983. Technical report, 15:49610 (R;US)
X-ray spectrometry in vivo a Si(Li)-NaI(T1) detector, 15:49352 (J;US)
PLUTONIUM 240
Collective bands in actinide nuclei and rare-earth elements in the SU(3) scheme, 15:50025 (R;SU;In Russian)
US Mussel Watch Program: Transuranic element data from Woods Hole Oceanographic Institution 1976-1983. Technical report, 15:49610 (R;US)
PLUTONIUM COMPLEXES
Determination of non-metallic elements in actinide complexes by oxygen flask combustion (OFC): chlorine and fluorine, 15:48989 (R;IN)
PLUTONIUM COMPOUNDS
See also PLUTONIUM NITRIDES
Simulation of alpha continuous air monitor alarm response in the presence of plutonium, 15:49557 (R;US)
PLUTONIUM DIOXIDE
Thermophysical and thermochemical properties of fast reactor materials, 15:48872 (R;FR)
PLUTONIUM IONS
Optical study and analysis of Pu^{4+} in single crystals of $ZrSiO_4$, 15:49020 (RA;US)
PLUTONIUM NITRIDES
Design, construction and performance tests of atomic emission spectrograph with DCA and ICP excitation systems for plutonium bearing fuels, 15:48997 (R;JP;In Japanese)
PNA
See POLYCYCLIC AROMATIC HYDROCARBONS
PNL
See BATTELLE PACIFIC NORTHWEST LABORATORIES
POINT DEFECTS
The stability of irradiation-induced defects in NiAl, 15:48864 (R;US)
POISONS (CHEMICAL)
See HAZARDOUS MATERIALS
POISSON EQUATION
A Monte Carlo boundary propagation method for the solution of Poisson's equation, 15:50225 (R;US)

POLAR COMPOUNDS
Sticky molecules in nonpolar solvents: Importance of hydrogen bonding in the hydration and aggregation of polar molecules, 15:49088 (BA;US)
POLAR SUBSTORMS
See MAGNETIC BAYS
POLARIMETERS
Plan for focal plane polarimeter for Grand Raiden, 15:49317 (RA;JP;In Japanese)
POLARIZED TARGETS
Realizations of polarized targets in storage rings, 15:49277 (R;US)
POLLUTANTS
Atmospheric fates of air pollutants, 15:49551 (RA;FI)
Chemical data bases for the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1, 15:49151 (R;US)
POLY(ISOBUTYLENE OXIDE)
See ORGANIC POLYMERS
POLY(VINYLIDENE FLUORIDE)
See FLUORINATED ALIPHATIC HYDROCARBONS
POLYVINYLS
POLYACRYLONITRILE
See ORGANIC POLYMERS
POLYATOMIC MOLECULES
Crossed molecular beams, 15:49050 (RA;US)
Work in progress, 15:50231 (RA;US)
POLYCRYSTALS
Optical and mechanical properties of hot-pressed cesium iodide, 15:48941 (J;US)
POLYCYCLIC AROMATIC HYDROCARBONS
Appendix to Report No. 758474011. Integrated criteria document PAH: Republication of Addendum to Report No. 758474007, March 1989. Effects of 10 selected compounds, 15:49725 (R;NL)
Final response to BDAT related comments document. Mixed radioactive hazardous wastes, polynuclear aromatic u wastes, halogenated aliphatic U wastes, non-halogenated aromatic U wastes, F002-f006, F019. Volume 1-J, 15:49525 (R;US)
Integrated criteria document: PAHs, 15:49724 (R;NL)
POLYETHYLENES
Electron irradiation of poly(tetrafluoroethylene): Effect on adhesion and comparison with X-rays, 15:49146 (J;US)
Latent thermal energy storage using form-stable high-density polyethylene, 15:48475 (R;JP)
POLYMERS
See also INORGANIC POLYMERS
ORGANIC POLYMERS
SILICONES
Analysis and prediction of thermal properties of mesophases and crystals by calorimetry and supercomputers, 15:48953 (R;US)
Models for organometallic polymers: Zigzag chains of $Mo_2(O_2CCH_3)_4$ units linked by dimethylphospinoethane (dmpe) and tetramethylethylenediamine (tmeda) ligands, 15:49055 (RA;US)
Morphological analysis of ionomers: Progress report, April 1, 1989–March 31, 1990, 15:48954 (R;US)
POLYNUCLEAR AROMATIC HYDROCARBONS
See POLYCYCLIC AROMATIC HYDROCARBONS
POLYOLEFINS
See also POLYETHYLENES
Crosslinking of thermoplastics by gamma-irradiation in industrial conditions, 15:48401 (R;GB)
POLYPEPTIDES
Combined capillary electrophoresis and electrospray ionization mass spectrometry, 15:49025 (R;US)
POLYSULFIDES
See SULFIDES
POLYTETRAOXANE
See ORGANIC POLYMERS
POLYTHENE
See POLYETHYLENES
POLYURETHANES
Morphological analysis of ionomers: Progress report, April 1, 1989–March 31, 1990, 15:48954 (R;US)
POLYVINYL CHLORIDE
See PVC
POLYVINYLS
See also PVC
Chemical characterization of the surface sites of coal: Technical progress report, April–June 1989, 15:48084 (R;US)
PONDS
See also COOLING PONDS
Health assessment for Tex Tin Corporation, National Priorities List Site, Texas City, Texas, Region 6. CERCLIS No. TXD062113329. Preliminary report, 15:49617 (R;US)
PONDS (COOLING)
See COOLING PONDS
POOL TYPE REACTORS
Inherent reactor power controller for a metal-fueled ALMR, 15:48617 (J;US)
POOLS
See PONDS
PORPHYRINS
See also HEMOGLOBIN
Distribution of a crystalline nickel (II) porphyrin in the Green River Formation, 15:48206 (R;US)
Hydrogen-atom tunneling in the thermal tautomerism of porphine imbedded in a n-hexane matrix, 15:49127 (RA;US)
POSITION SENSITIVE DETECTORS
A fast large-area position-sensitive time-of-flight neutron detection system, 15:49320 (J;US)
Design considerations for a single tube gamma camera, 15:49348 (J;US)
Detector, shielding and geometric design factors for a high-resolution PET system, 15:49347 (J;US)
POSITRON BEAMS
Initial performance of the wire imaging synchrotron radiation detector, 15:49268 (J;US)
POSITRON CAMERAS
Calibration of detector sensitivity in positron cameras, 15:50064 (J;US)
POSITRON COLLISIONS
The physics of electronic and atomic collisions, 15:49868 (B;US)
POSITRON COMPUTED TOMOGRAPHY
3-D phantom to simulate cerebral blood flow and metabolic images for PET, 15:49701 (J;US)
A new generation of SPECT and PET systems based on position sensitive photomultipliers, 15:49363 (J;US)
A study of data loss and mispositioning due to pileup in 2-D detectors in PET, 15:49700 (J;US)
Accelerated image reconstruction for a cylindrical positron tomograph using Fourier domain methods, 15:49351 (J;US)
Application of mathematical removal of positron range blurrigg in positron emission tomography, 15:49360 (J;US)
Characterization of a whole body imaging technique for PET, 15:49699 (J;US)
Constrained least squares filtering in high resolution PET and SPECT imaging, 15:49349 (J;US)
Detector, shielding and geometric design factors for a high-resolution PET system, 15:49347 (J;US)
Measuring PET scanner sensitivity: Relating count rates to image signal-to-noise ratios using noise equivalent counts, 15:49350 (J;US)
Nuclear medicine and quantitative imaging research (instrumentation and quantitative methods of evaluation): Progress report, January 15–September 1, 1990, 15:49687 (R;US)
Test of the HISPET prototype, 15:49353 (J;US)
POSITRONS
Influence of the Ore slot on the positron energy distribution function, 15:49879 (R;UA;In Russian)
POTASSIUM
Catalysis of carbon gasification: Influence of different modes of addition of catalysts. Annual report, January 1989-January 1990, 15:48081 (R;US)
POTASSIUM CHLORIDES
Mechanisms of surface enrichment and adhesion of coal combustion particulates: Sixth and seventh quarterly reports, December 16, 1987–June 15, 1988, 15:48112 (R;US)

POTASSIUM COMPLEXES
Electron exchange between potassium bis(t-butyl(8)annulene)ytterbate(II) and potassium bis(t-butyl(8)annulene)ytterbate(III), 15:49061 (RA;US)

POTASSIUM OXIDES
Superconducting and structural properties of the $(Ba_{0.6}K_{0.4})(Bi_{1-y}Sb_y)O_3$ system, 15:48910 (R;US)

POTENTIAL (ELECTRIC)
See ELECTRIC POTENTIAL

POTENTIAL ENERGY
Hyperdeformed pear-shaped nuclei, 15:50015 (R;FR)

POWDERS
Determination of flow-regime boundaries for cohesive particles: Quarterly report, December 20, 1989–March 20, 1990, 15:48211 (R;US)

POWER DISTRIBUTION SYSTEMS
DER 89: main facts, 15:48736 (R;FR;In French)
Glossary of lineman: English French, French-English, 15:48675 (R;CA)

POWER GENERATION
Cogeneration and independent power production: Market insight and outlook: Final report, 15:48750 (R;US)
Power generation using a low power Organic Rankine Cycle, 15:48492 (R;FI;In Finnish)
Technical assessment and economic study of compressed air energy storage in Japan, 15:48685 (R;JP;In Japanese)

POWER LOSSES
DOEL 4 - loss of external load transient: Simulation and analysis, 15:48556 (RA;XA)

POWER PLANTS
See also DUAL-PURPOSE POWER PLANTS
FUEL CELL POWER PLANTS
HYDROELECTRIC POWER PLANTS
PEAKING POWER PLANTS
THERMONUCLEAR POWER PLANTS
Guide for the application and use of valves in power plant systems: Final report, 15:48602 (R;US)
Report to Dept. of Supply and Services on the economics of cool storage for Bell Northern Research Lab 5, Ottawa, Ontario and a comparison of chilled water with three types of ice-storage modules, 15:48688 (R;CA)
Thermal energy storage for integrated gasification combined-cycle power plants, 15:48496 (R;US)
Updated comparison of economics of fusion reactors with advanced fission reactors, 15:50168 (R;US)

POWER POOLS
See INTERCONNECTED POWER SYSTEMS

POWER REACTORS
See also ANGRA-1 REACTOR
CHERNOBYLSK-4 REACTOR
DOEL-4 REACTOR
DRESDEN-2 REACTOR
EBR-2 REACTOR
IGNALINSK-1 REACTOR
IGNALINSK-2 REACTOR
LAGUNA VERDE-1 REACTOR
MONJU REACTOR
N-REACTOR
NARORA-1 REACTOR
NARORA-2 REACTOR
PEACH BOTTOM-2 REACTOR
SNR REACTOR
SEQUOYAH-1 REACTOR
SURRY-1 REACTOR
DER 89: main facts, 15:48736 (R;FR;In French)
IAEA activities in computer aided safety analysis, 15:48519 (RA;XA)
Nuclear plant aging research in the United States, 15:48522 (RA;XA)
Verification of computer codes used in licensing, 15:48587 (RA;XA)

POWER TRANSMISSION LINES
Atmospheric corrosion of transmission line conductors: Literature review, 15:48676 (R;CA)
Guidelines for an environmental impact assessment of a 345 kV transmission line from Salisbury to Bathurst/Belledune, 15:48682 (R;CA)
Guidelines for an environmental impact assessment of a 345-kV transmission line from Salisbury to Bathurst/Belledune, 15:48680 (R;CA)
Guidelines for an environmental impact assessment of the second New England intertie 345 kV transmission line, 15:48681 (R;CA)
Guidelines for an environmental impact assessment of the second New England intertie 345-kV transmission line, 15:48679 (R;CA)

POWER TRANSMISSION TOWERS
A statistical comparison of uplift design methods for augered footings in sand, 15:48970 (R;CA)
Field evaluation of grillage foundation uplift capacity: Final report, 15:48674 (R;US)

PRASEODYMIUM COMPLEXES
On the stability and bonding in bis(η-arene)lanthanide complexes, 15:49063 (RA;US)

PREAMPLIFIERS
A high speed, high gain preamplifier system for silicon strip detectors, 15:49340 (J;US)
A high speed, low noise ASIC preamplifier for silicon strip detectors, 15:49343 (J;US)
An improved operating mode for a Si(Li) x-ray spectrometer, 15:49330 (J;US)

PRECIPITATIONS (ATMOSPHERIC)
See ATMOSPHERIC PRECIPITATIONS

PRESSURE TUBES
A review of the UK PWR structural integrity and materials programme, 15:48565 (RA;XA)
Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components, Vienna, 18-20 October 1988: Summary report, 15:48520 (R;XA)
Overview of the recent results of the safety related research in pressure boundary components of Finnish nuclear power plants, 15:48521 (RA;XA)
PISC III: Third programme for the inspection of steel components, 15:48606 (RA;XA)
Principal trends of investigation on substantiation of WWER vessel material serviceability, 15:48568 (RA;XA)
Research programs for LWR pressure boundary components in Japan, 15:48535 (RA;XA)
Review of research activities in the area of reliability of reactor pressure components in Yugoslavia, 15:48566 (RA;XA)
Some ongoing R and D programs in the United States that relate to reactor pressure components, 15:48524 (RA;XA)

PRESSURE VESSELS
Aging
Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components, Vienna, 18-20 October 1988: Summary report, 15:48520 (R;XA)

Annealing
Report on the interregional training course on implication of radiation induced embrittlement for the integrity of pressure vessels, 15:48604 (RA;XA)

Coordinated Research Programs
A review of the UK PWR structural integrity and materials programme, 15:48565 (RA;XA)
Safety and reliability of reactor pressure components - Research activities in the German Democratic Republic, 15:48562 (RA;XA)
Some ongoing R and D programs in the United States that relate to reactor pressure components, 15:48524 (RA;XA)

Crack Propagation
Proceedings of the third International Atomic Energy Agency specialist's meeting on subcritical crack growth: Opening session and Technical session 1, 15:48537 (R;US)
Proceedings of the third International Atomic Energy Agency specialists' meeting on subcritical crack growth: Technical sessions 2, 3, and 4 and Recommendations and conclusions Session 5, 15:48538 (R;US)

Recommendations for the shallow-crack fracture toughness testing task within the HSST [Heavy-Section Steel Technology] Program, 15:48571 (R;US)

Embrittlement
Investigation of materials from decommissioned reactor pressure vessel - a contribution to the understanding of irradiation embrittlement, 15:48605 (RA;XA)
Report on the interregional training course on implication of radiation induced embrittlement for the integrity of pressure vessels, 15:48604 (RA;XA)

Fatigue
Main current development programs in Belgium, 15:48607 (RA;XA)

Fracture Mechanics
Proceedings of the third International Atomic Energy Agency specialists' meeting on subcritical crack growth: Technical sessions 2, 3, and 4 and Recommendations and conclusions Session 5, 15:48538 (R;US)
Recommendations for the shallow-crack fracture toughness testing task within the HSST [Heavy-Section Steel Technology] Program, 15:48571 (R;US)

Fracture Properties
A review of the UK PWR structural integrity and materials programme, 15:48565 (RA;XA)
Some ongoing R and D programs in the United States that relate to reactor pressure components, 15:48524 (RA;XA)

Gamma Dosimetry
[Reactor dosimetry]: Foreign trip report, August 24, 1990–September 4, 1990, 15:48668 (R;US)

In-Service Inspection
Main current development programs in Belgium, 15:48607 (RA;XA)
The Spanish national program on the reliability of reactor pressure components, 15:48569 (RA;XA)

Materials Testing
R and D projects in reactor technology at the Swedish Plant Inspectorate (SA), 15:48536 (RA;XA)

Mechanical Properties
Crack-arrest behavior in SEN wide plates of low-upper-shelf base metal tested under nonisothermal conditions: WP-2 series, 15:48608 (R;US)

Mechanical Tests
Overview of the recent results of the safety related research in pressure boundary components of Finnish nuclear power plants, 15:48521 (RA;XA)

Meetings
Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components, Vienna, 18-20 October 1988: Summary report, 15:48520 (R;XA)

Neutron Dosimetry
[Reactor dosimetry]: Foreign trip report, August 24, 1990–September 4, 1990, 15:48668 (R;US)

Nondestructive Testing
PISC III: Third programme for the inspection of steel components, 15:48606 (RA;XA)

Physical Radiation Effects
[High-temperature reactor materials for gas-cooled reactor]: Foreign trip report, August 24, 1990–September 1, 1990, 15:48578 (R;US)

Post-Irradiation Examination
Investigation of materials from decommissioned reactor pressure vessel - a contribution to the understanding of irradiation embrittlement, 15:48605 (RA;XA)

Reactor Safety
Safety and reliability of reactor pressure components - Research activities in the German Democratic Republic, 15:48562 (RA;XA)

Reliability
Ninth regular meeting of the International Working Group on Reliability of Reactor Pressure Components, Vienna, 18-20 October 1988: Summary report, 15:48520 (R;XA)
Principal trends of investigation on substantiation of WWER vessel material serviceability, 15:48568 (RA;XA)
Review of research activities in the area of reliability of reactor pressure components in Yugoslavia, 15:48566 (RA;XA)

Research Programs
Principal trends of investigation on substantiation of WWER vessel material serviceability, 15:48568 (RA;XA)
Review of research activities in the area of reliability of reactor pressure components in Yugoslavia, 15:48566 (RA;XA)

Submerged Arc Welding
Weld process development for fabrication of heavy wall pressure vessel: Part 3, 15:48858 (R;CA)

Thermal Stresses
Sensitivity analysis approach to P-T limits and pressurized thermal transient, 15:48567 (RA;XA)

Transients
Sensitivity analysis approach to P-T limits and pressurized thermal transient, 15:48567 (RA;XA)

PRESSURIZED WATER COOLED MODERATED REACTOR
See PWR TYPE REACTORS

PRESSURIZED WATER REACTORS
See PWR TYPE REACTORS

PRICES
See also TIME-OF-USE PRICING
Survey of utility real-time pricing programs in the U.S, 15:48683 (R;JP;In Japanese)

PRIMARY BATTERIES
A lithium/C_2F primary battery, 15:49098 (RA;US)

PRINCE EDWARD ISLAND
Maritime Electric Co. Ltd. annual report, 1989, 15:48752 (R;CA)

PRINTED CIRCUITS
Ion chromatography in the manufacture of multilayer circuit boards, 15:49209 (R;US)

PROCESS CONTROL
Artificial intelligence in process control, 15:48110 (RA;US)
Energy efficiency in industrial processes: Future R and D requirements: Proceedings of the CEC seminar, 15:48808 (R;LU)
Industrial processes: Proceedings of a contractors' meeting, 15:48809 (R;LU)
Short and long loop manufacturing feedback using a multisensor assembly test chip, 15:49191 (R;US)

PROCESS SOLUTIONS
Work in progress, 15:49072 (RA;US)

PROCESSING (ORES)
See ORE PROCESSING

PRODUCTION
Development of an energy management system, 15:48831 (R;FI;In Finnish)
Utilization of resources of the wood pulping industry - a holistic view, 15:48826 (RA;FI)

PRODUCTION (PARTICLE)
See PARTICLE PRODUCTION

PRODUCTION REACTORS
Modeling issues associated with production reactor safety assessment, 15:48660 (R;US)

PROGRAMMING LANGUAGES
SISAL versus FORTRAN: A comparison using the Livermore Loops: Revision 2, 15:50242 (R;US)

PROJECTILES
Railgun performance with a two-stage light-gas gun injector: Revision 1, 15:49167 (R;US)

PROMPT GAMMA RADIATION
Thermal-neutron capture gamma-rays, 15:49987 (R;XA)

PROPAGATION (WAVE)
See WAVE PROPAGATION

PROPAGATOR
Correct short-time propagator for Feynman path integration by power-series expansion in Δt, 15:50230 (RA;US)
Monte Carlo path integration for the real-time propagator, 15:50227 (RA;US)

PROPANE
Propane storage. Report on hazard and risk assessment of propane storage on garage forecourts, 15:48191 (R;CA)

PROTACTINIUM BROMIDES
Analysis of the $5f^1 \rightarrow 6d^1$ transitions in PaX_6^{2-} (X = Cl, Br) and $Pa^{4+}/ThBr_4$, 15:49019 (RA;US)

PROTACTINIUM CHLORIDES
Analysis of the $5f^1 \rightarrow 6d^1$ transitions in PaX_6^{2-} (X = Cl, Br) and $Pa^{4+}/ThBr_4$, 15:49019 (RA;US)
PROTECTION
See SAFETY
PROTECTION (RADIATION)
See RADIATION PROTECTION
PROTEIN DENATURATION
The effect of denaturation and reduction on cellobiohydrolase 1 from Trichoderma reesei, 15:49642 (R;US)
PROTEINS
See also PHYTOCHROMES
Combined capillary electrophoresis and electrospray ionization mass spectrometry, 15:49025 (R;US)
PROTON BEAMS
Monitoring system for relativistic particles and nuclei, 15:49260 (R;SU)
The new conceptual design of snakes and spin rotators in RHIC, 15:49230 (R;US)
PROTON REACTIONS
Cumulative K^--meson production by protons with energy of 10 GeV, 15:49988 (R;SU;In Russian)
Inelastic proton scattering from deformed nuclei at intermediate energy, 15:50049 (RA;JP;In Japanese)
Production of high energy nuclei ^4He,^3He,^3H,^2H in interaction 10.1 GeV/c protons with Be,Al,Cu,Ta, 15:50032 (R;SU)
Production of light mesons in P + D reactions, 15:49903 (R;FR)
Study of multiparticle correlations in 200-400 GeV range, 15:49992 (R;SU;In Russian)
PROTON-ANTIPROTON INTERACTIONS
An impact parameter analysis of antiproton-proton elastic and inelastic scattering at 22.4 GeV/c, 15:49950 (R;SU;In Russian)
Analysis of the reaction p-barp→Λ-barΛ near the threshold, 15:49940 (R;SU)
Massive straight-line string as a model of heavy quarkonium, 15:49932 (R;SU;In Russian)
On energy dependence of the width and shape of the rapidity distribution of negatively charged particles, 15:49927 (R;SU;In Russian)
Saturation of hadron process at high energies: alternative approaches to its realization, 15:49948 (R;UA)
Topics in low-energy p-barp interactions, 15:49942 (R;SU)
PROTON-NEUTRON INTERACTIONS
The proton-neutron residual interaction in nuclear structure, 15:50019 (R;US)
PROTON-PROTON INTERACTIONS
About a possibility to study the diffraction dissociation on the vertex detector spectrometer, 15:49306 (R;SU;In Russian)
On energy dependence of the width and shape of the rapidity distribution of negatively charged particles, 15:49927 (R;SU;In Russian)
Possible change of growth regime for the total cross section of hadron processes at E_0 >or approx. 10^{15} eV, 15:49956 (R;SU;In Russian)
Saturation of hadron process at high energies: alternative approaches to its realization, 15:49948 (R;UA)
Study of multiparticle correlations in 200-400 GeV range, 15:49992 (R;SU;In Russian)
PROTONS
Automodelity of proton cluster distributions in the range of the first intermediate asymptotics, 15:50036 (RA;SU;In Russian)
Cumulative nucleon production in ^3Hep- and ^3Hp interactions at momenta of colliding nuclei 5 GeV/c, 15:49997 (R;SU;In Russian)
Simulation of angle interval distribution in collisions of relativistic nuclei and comparison with experiment, 15:50046 (RA;SU;In Russian)
Strange goings-on in the proton: a case for sheshire cat, 15:49921 (R;FR)
PROTOSTARS
The environment of young stellar objects studied by high-resolution infrared spectroscopy, 15:49768 (RA;FR)
PROTOTYPE FAST REACTOR JAPAN
See MONJU REACTOR
PSI RESONANCES
See MESONS
PSI-4300 RESONANCES
See MESONS
PUBLIC BUILDINGS
Evaluation of the energy consumption of the public sector in Quebec, 1985-1986, 15:48743 (R;CA)
PULMONARY CANCER
See CARCINOMAS
PULMONARY LAVAGE
See LUNGS
PULSARS
Self-sustained mechanism of mass transfer and evolution of very low mass x-ray binaries, 15:49841 (BA;US)
PULSATING VARIABLE STARS
Pulsating variables, 15:49830 (RA;ZA)
PULSE AMPLIFIERS
Assessment of TFT amplifiers for a-Si:H PIXEL particle detectors, 15:49356 (J;US)
PULVERIZED FUEL ASH
See FLY ASH
PUMPING
Irrigation pumping plant evaluation: Interim report, 15:48820 (R;CA)
PUREX PROCESS
Purification of degraded TBP solvent using macroreticular anion exchange resin, 15:48222 (R;IN)
PVC
Chemical characterization of the surface sites of coal: Technical progress report, April–June 1989, 15:48084 (R;US)
PWR TYPE REACTORS
See also ANGRA-1 REACTOR
DOEL-4 REACTOR
QINSHAN REACTOR
SEQUOYAH-1 REACTOR
SURRY-1 REACTOR
WWER TYPE REACTORS
Atws
Contribution of Anticipated Transients Without Scram (ATWS) to core melt at United States nuclear power plants, 15:48647 (R;US)
Bibliographies
Overview and comparison of US commercial nuclear power plants: Nuclear power plant system sourcebook, 15:48539 (R;US)
Computerized Simulation
The GRS thermalhydraulic system code ATHLET, 15:48533 (RA;XA)
Containment
Quantitative analysis of potential performance improvements for the dry PWR [pressurized water reactor] containment, 15:48667 (R;US)
Excursions
Analysis of reactivity accidents in PWR'S, 15:48541 (R;FR)
Fuel Rods
Irradiation testing of SIEMENS/KWU LWR fuel in the HFR Petten, 15:48531 (RA;FR)
Gamma Dosimetry
[Reactor dosimetry]: Foreign trip report, August 24, 1990–September 4, 1990, 15:48668 (R;US)
Loss Of Coolant
Bias in peak clad temperature predictions due to uncertainties in modeling of ECC bypass and dissolved non-condensable gas phenomena, 15:48664 (R;US)
Dispositions taken in France to limit gaseous releases from PWR power plants in abnormal operating conditions, 15:48540 (R;FR)
Licensing analysis of steam generator tube plugging: Influence on LB-LOCA, 15:48558 (RA;XA)
Multiloop Integral System Test (MIST): Final report: MIST Phase 4 tests, 15:48666 (R;US)
Multiloop Integral System Test (MIST): Final report: MIST phase 4 tests: Volume 11, 15:48665 (R;US)
Post-test analysis of SPE-2 with TRAC-PF1, 15:48550 (RA;XA)

The MERLIN programme: Pt. 2, A description of the MERLIN rig, 15:48662 (R;GB)

Meltdown
Siemens UB KWU-Code package for severe accidents, 15:48560 (RA;XA)

Mixed Oxide Fuels
Safety problems related to the use of MOX assemblies in PWRS, 15:48543 (R;FR)

Neutron Dosimetry
[Reactor dosimetry]: Foreign trip report, August 24, 1990–September 4, 1990, 15:48668 (R;US)

Pressure Vessels
Proceedings of the third International Atomic Energy Agency specialist's meeting on subcritical crack growth: Opening session and Technical session 1, 15:48537 (R;US)
Proceedings of the third International Atomic Energy Agency specialists' meeting on subcritical crack growth: Technical sessions 2, 3, and 4 and Recommendations and conclusions Session 5, 15:48538 (R;US)
Recommendations for the shallow-crack fracture toughness testing task within the HSST [Heavy-Section Steel Technology] Program, 15:48571 (R;US)

Reactor Components
Overview and comparison of US commercial nuclear power plants: Nuclear power plant system sourcebook, 15:48539 (R;US)

Reactor Cooling Systems
Measurement of two-phase flow momentum with force transducers, 15:48645 (R;US)
Multiloop Integral System Test (MIST): Final report: MIST Phase 4 tests, 15:48666 (R;US)
Multiloop Integral System Test (MIST): Final report: MIST phase 4 tests: Volume 11, 15:48665 (R;US)
Proceedings of the third International Atomic Energy Agency specialist's meeting on subcritical crack growth: Opening session and Technical session 1, 15:48537 (R;US)
The effect of dissolved zinc on the transport of corrosion products in PWRs: Final report, 15:48544 (R;US)

Reactor Operation
Licensee Event Report (LER) compilation for month of August 1990: Volume 9, No. 8, 15:48592 (R;US)

Reactor Safety
Inherently safe characteristics of nuclear reactors, 15:48532 (R;FR)
Nuclear safety in France, 15:48542 (R;FR)

Reactor Vessels
Recommendations for the shallow-crack fracture toughness testing task within the HSST [Heavy-Section Steel Technology] Program, 15:48571 (R;US)

Rewetting
Evaluation report on SCTF Core-III Test S3-20: Investigation of water break-through and core cooling behaviors under intermittent ECC water delivery to upper plenum during reflood phase in PWRs with combined-injection type ECCS, 15:48657 (R;JP)

Risk Assessment
Quantitative analysis of potential performance improvements for the dry PWR [pressurized water reactor] containment, 15:48667 (R;US)

Safety
Analysis of reactivity accidents in PWR'S, 15:48541 (R;FR)

Spent Fuels
Reactor critical benchmark calculations for burnup credit applications, 15:48231 (R;US)

PYRENE
Fluorescence line-narrowing spectral analysis of in vivo human hemoglobin-benzo[a]pyrene adducts: Comparison to synthetic analogues, 15:49646 (BA;US)

PYRIDINE
Chemical characterization of the surface sites of coal: Technical progress report, April–June 1990, 15:48085 (R;US)

PYRIDINES
See also PYRIDINE
Best demonstrated available technology (BDAT) background document for stripping still tails from the production of methyl ethyl pyridines K026. Final report, 15:49509 (R;US)

PYRITE
Chemical characterization of the surface sites of coal: Technical progress report, April–June 1990, 15:48085 (R;US)
Insights on pyritic sulfur in coal from image analysis, 15:48089 (R;US)

PYRITES
See PYRITE

PYROLYSIS
See also CRACKING
Advanced biomass pyrolysis technology in the US, 15:48419 (RA;LU)
Advanced vacuum pyrolysis project: State of the art and perspectives, 15:48421 (RA;LU)
Pyrolysis technology and products - Introduction, 15:48417 (RA;LU)
The pyrolysis technology a perspective for the future, 15:48414 (RA;LU)

PYROLYSIS PRODUCTS
See also PYROLYTIC GASES
PYROLYTIC OILS
Pyrolysis of biomass - A vertical flow packed-bed system: Production of char, oil and gases, 15:48428 (RA;LU)
Pyrolysis of biomass for the production of char, oil and gases, 15:48427 (RA;LU)

PYROLYTIC GASES
Flexibility of mass produced engines as shaft power and electricity conversion carriers for biomass derived fuels, 15:48430 (RA;LU)

PYROLYTIC OILS
A pyrolysis mill for fast pyrolysis of biomass, 15:48423 (RA;LU)
Advanced biomass pyrolysis technology in the US, 15:48419 (RA;LU)
Advanced vacuum pyrolysis project: State of the art and perspectives, 15:48421 (RA;LU)
Alten activities in the field of biomass exploitation for energetic uses, 15:48429 (RA;LU)
Catalytic treatment of pyrolysis oils, 15:48435 (R;LU)
Characterization and upgrading of pyrolytic oils, 15:48425 (RA;LU)
Flexibility of mass produced engines as shaft power and electricity conversion carriers for biomass derived fuels, 15:48430 (RA;LU)
Pyrolysis liquids: Problems and opportunities for utilization, 15:48426 (RA;LU)
The pyrolysis for biomass is available in industry-scale and ready for the production of energy, 15:48418 (RA;LU)
Thermal conversion of biomass to liquids by the Waterloo Fast Pyrolysis Process, 15:48422 (RA;LU)

PYROPHOSPHATES
Raman spectra of molybdenum phosphate glasses and some crystalline analogues, 15:48946 (J;US)

Q

QINSHAN REACTOR
Applications of safety analysis codes at the Institute of Atomic Energy, Beijing, 15:48547 (RA;XA)

QUANTUM CHROMODYNAMICS
Limits on compositeness of quarks and leptons from e^+e^- annihilation, 15:49977 (R;DE)

QUANTUM ELECTRODYNAMICS
High-energy atomic physics, 15:49887 (RA;US)

QUANTUM FIELD THEORY
See also LATTICE FIELD THEORY
PHI4-FIELD THEORY
QUANTUM CHROMODYNAMICS
QUANTUM ELECTRODYNAMICS
QUANTUM GRAVITY

Method of exact solutions in investigating the electromagnetic field influence on different quantum processes, 15:49944 (R;UA;In Russian)
Topological quantum field theories in higher dimensions, 15:49974 (RA;JP)

QUANTUM GRAVITY
A new field experiment in the Greenland ice cap to test Newton's inverse square law, 15:50107 (BA;US)

QUANTUM MECHANICS
Real and complex scaling methods in atoms and molecules, 15:49860 (RA;BR;In Spanish)

QUARK MATERIAL
See QUARK MATTER

QUARK MATTER
Filamentation in quark plasma at finite temperatures, 15:49925 (R;SU;In Russian)
Search for strangeness-abundant quark-gluon matter in nucleus-nucleus and antiproton-nucleus interactions, 15:50042 (R;SU;In Russian)

QUARK PLASMA
See QUARK MATTER

QUARK SEA
See QUARK MATTER

QUARK-ANTIQUARK INTERACTIONS
One-gluon exchange approximation for quasipotential of two-quark interaction in quantum chromodynamics, 15:49929 (R;SU)

QUARK-GLUON PLASMA
See QUARK MATTER

QUARK-QUARK INTERACTIONS
One-gluon exchange approximation for quasipotential of two-quark interaction in quantum chromodynamics, 15:49929 (R;SU)

QUARKS
Color flux distribution in pure SU(2) Lattice Gauge Theory, 15:49924 (R;US)
Excited quark production at ep and γp colliders, 15:49933 (R;SU)
Light quark mass relations from finite energy sum rules, 15:49947 (R;UA)

QUASARS
Hα emission lines in high redshift quasars, 15:49799 (RA;FR)
Mutual coherent properties of the images of the quasar microlensed by star mass, 15:49816 (R;UA)
Thermal Comptonization models for gamma-ray emission from black-hole sources, 15:49846 (BA;US)

QUASI PARTICLES
See also PHONONS
Quasiparticle mixers and detectors, 15:49319 (BA;US)

QUASI-FREE REACTIONS
Cross section and analyzing power for quasifree (p,n) reactions, 15:50000 (R;US)

QUASIPARTICLE-PHONON MODEL
The multiphonon version of the quasiparticle-phonon nuclear model: application to the problem of existence of low-lying two-phonon states in deformed nuclei, 15:50039 (R;SU)

QUEBEC
Assessment of the organics containment plume at Ville-Mercier, Quebec, Canada, 15:49586 (RA;CA)
Evaluation of the energy consumption of the public sector in Quebec, 1985-1986, 15:48743 (R;CA)
Operation of an isolated mini-hydro plant in northern Quebec, 15:48448 (RA;CA)

R

R-1650 RESONANCES
See MESONS

RACIAL GROUPS
See MINORITY GROUPS

RADAR
Development of buried cable location survey system by underground rader for power distribution cables under pavements, 15:48673 (R;JP;In Japanese)

RADIATION DECONTAMINATION
See DECONTAMINATION

RADIATION DETECTION AND RANGE
See RADAR

RADIATION DETECTORS
See also CHERENKOV COUNTERS
DIELECTRIC TRACK DETECTORS
IONIZATION CHAMBERS
NEUTRON DETECTORS
PHOTOGRAPHIC FILM DETECTORS
POSITION SENSITIVE DETECTORS
SCINTILLATION COUNTERS
SHOWER COUNTERS
TRANSITION RADIATION DETECTORS
Advantages of a modular design approach for radiological instrumentation, 15:49561 (J;US)
Optical data transmission at the superconducting super collider, 15:49368 (J;US)

RADIATION HYGIENE
See RADIATION PROTECTION

RADIATION MONITORING
Environmental survey at Lucas Heights Research Laboratories, 1987, 15:48372 (R;AU)

RADIATION PROTECTION
Radiation protection of the public: Past, present, and future, 15:50063 (R;US)

RADIATION SAFETY
See RADIATION PROTECTION

RADIATION TRANSPORT
Random number stride in Monte Carlo calculations, 15:50103 (R;US)

RADICALS
See also METHYLENE RADICALS
VINYLIDENE RADICALS
Selective photochemistry, 15:49126 (RA;US)
Work in progress, 15:49128 (RA;US)
Work in progress, 15:49142 (RA;US)
Work in progress, 15:49128 (RA;US)

RADIOACTIVE AEROSOLS
Simulation of alpha continuous air monitor alarm response in the presence of plutonium, 15:49557 (R;US)
State of Washington Department of Health, radioactive air emissions Permit FF01: Supplemental information, 15:48618 (R;US)

RADIOACTIVE BIOLOGICAL WASTES
See RADIOACTIVE WASTES

RADIOACTIVE EFFLUENTS
State of Washington Department of Health, radioactive air emissions Permit FF01: Supplemental information, 15:48618 (R;US)

RADIOACTIVE GASEOUS WASTES
See RADIOACTIVE WASTES

RADIOACTIVE MATERIALS
See also FISSION PRODUCTS
RADIOACTIVE WASTES
Hanford Environmental Dose Reconstruction Project: Monthly report, August 1990, 15:49546 (R;US)
Modern chemical analysis of nuclear materials, 15:48995 (R;US)
Supplemental mathematical formulations: The Multimedia Environmental Pollutant Assessment System (MEPAS), 15:49547 (R;US)
Thorium handling environmental assessment, Feed Materials Production Center, Fernald, Ohio, 15:48262 (R;US)

RADIOACTIVE PARTICULATES
See PARTICLES
RADIOACTIVE AEROSOLS

RADIOACTIVE WASTE DISPOSAL
Application of ADINAT/ADINA and MINIMEF codes to the resolution of the different exercises of COSA project, 15:48270 (R;FR;In Spanish)
Assessment of the agricultural implications of land burial of radioactive wastes: soil processes, 15:48256 (R;GB)
High-level radwaste plans in nine countries, 15:48371 (J;US)

Hydrothermal alterations as natural analogues of radionuclide migration in granitic rocks, 15:48272 (R;FR;In French)
Objectives, standards and criteria for radioactive waste disposal in the European Community: Euradwaste series No 1 Report of a working group on Joint elaboration of radioactive waste-management policies, 15:48281 (R;FR)
Reactor operating waste-disposal program: 1989 progress report, 15:48285 (R;CA)
Social issues and challenges in the disposal of nuclear waste, 15:48363 (BA;US)
Stress analysis of HLW containers Preliminary ring test exercise Compas project, 15:48278 (R;FR)
VANDAL technical overview: VANDAL version 1.1 (Risk assessment in radioactive waste disposal.), 15:48267 (R;GB)
VANDAL user guide. V. 1.1: Input and execution (VANDAL version 1.1), 15:48264 (R;GB)
VANDAL user guide. V. 1.2: Input and execution appendices (VANDAL version 1.1) (Risk assessment in radioactive waste disposal.), 15:48265 (R;GB)
VANDAL user guide. V. 2.1: Output and error messages (VANDAL version 1.1) (Risk assessment in radioactive waste disposal.), 15:48266 (R;GB)
Waste management aspects of the Formerly Utilized Sites Remedial Action Program, 15:48258 (R;US)

RADIOACTIVE WASTE FACILITIES

See also ASSE SALT MINE
WIPP

Computerized Simulation

Simulation modeling of subsurface development, 15:48324 (BA;US)

Containment

Simulation of radionuclide retardation at Yucca Mountain using a stochastic mineralogical/geochemical model, 15:48308 (BA;US)
Status of integrated performance assessment of the waste packages and engineering barrier system, 15:48316 (BA;US)

Design

Preclosure safety analysis for a prospective Yucca Mountain conceptual design repository, 15:48317 (BA;US)
Preliminary conceptual design description of the proposed DOE store-only monitored retrievable storage (MRS) facility, 15:48357 (BA;US)
Vitrification of defense high level radioactive waste at Savannah River and Hanford, 15:48325 (BA;US)

Economic Impact

Hedonic price theory: Concept and applications, 15:48344 (BA;US)

Emission

Natural radionuclides in groundwater from J-13 well at the Nevada test site, 15:48310 (BA;US)
One-dimensional radionuclide transport under time-varying conditions, 15:48305 (BA;US)
Simulation on reactive chemical transport in varying thermal field with reaction-flow coupling, 15:48306 (BA;US)

Feasibility Studies

Defining the need for and functions of the monitored retrievable storage (MRS) facility, 15:48327 (BA;US)

Geophysics

Diffusion barrier transport properties of unsaturated paintbrush tuff rubble backfill, 15:48314 (BA;US)

Hazards

Basaltic volcanic episodes of the Yucca Mountain region, 15:48296 (BA;US)

Hydrology

Hydrologic characterization of faults and other potentially conductive geologic features in the unsaturated zone, 15:48348 (BA;US)
Multi-dimensional modeling of unsaturated flow in the vicinity of exploration shafts and fault zones at Yucca Mountain, Nevada, 15:48347 (BA;US)

Licensing

A proposed methodology for validating performance assessment models for the DOE Office of Civilian Radioactive Waste Management Program, 15:48318 (BA;US)

Performance

Overview of the U.S. Department of Energy's PACE-90 geologic repository performance assessment exercise activity, 15:48355 (BA;US)

Planning

High-level radwaste plans in nine countries, 15:48371 (J;US)

Program Management

On-site representation and oversight: A special role for the state of the Nevada and Nye County in the civilian radioactive waste management program, 15:48312 (BA;US)

Public Policy

Public communication and participation activities in siting controversial facilities in the United States and Western Europe: An examination of lessons learned, 15:48311 (BA;US)
Two citizen task forces and the challenge of the evolving nuclear waste siting process, 15:48341 (BA;US)

Quality Assurance

The use of performance assessments in Yucca Mountain repository waste package design activities, 15:48354 (BA;US)

Radiation Hazards

Risk perspective on potential releases of ^{14}C from the geologic repository at Yucca Mountain, 15:48384 (BA;US)

Radiation Monitoring

Environmental impact assessment for a radioactive waste facility: A case study, 15:48259 (R;US)

Risk Assessment

Initiating event identification and screening for nuclear waste repository preclosure risk assessment, 15:48378 (BA;US)

Rock Mechanics

Rock mechanics aspects of the ESF design, 15:48301 (BA;US)

Safeguards

International safeguards relevant to geologic disposal of high-level wastes and spent fuels, 15:48302 (BA;US)

Safety Engineering

Ventilation design for the Exploratory Shaft Facility Yucca Mountain Project, 15:48376 (BA;US)

Site Characterization

An investigation of the mechanical and hydrologic behavior of tuff fractures under saturated conditions, 15:48337 (BA;US)
Application of geophysical methods for fracture characterization, 15:48331 (BA;US)
Approach to developing a ground-motion design basis for facilities important to safety at Yucca Mountain, 15:48307 (BA;US)
Building of a conceptual model at the UE25-c hole complex, 15:48339 (BA;US)
Combined analytical/numerical approaches to solving fluid flow problems in the unsaturated zone at Yucca Mountain, 15:48338 (BA;US)
Concepts in prototype testing for in situ geomechanical investigations at Yucca Mountain, 15:48333 (BA;US)
Diffusion coefficients and hydraulic conductivity in unsaturated Hanford soils and sediments, 15:48336 (BA;US)
Linkage between site characterization program and performance and design data needs, 15:48359 (BA;US)
Modeling of coupled heat-mass stress effects in geologic media, 15:48342 (BA;US)
Prelimary methodology for design of stable drifts for the Yucca Mountain Project, 15:48297 (BA;US)
Prototype testing for the Yucca Mountain project, 15:48335 (BA;US)
Role of underground testing to determine suitability of Yucca Mountain as a potential repository site, 15:48299 (BA;US)
Seismic characterization of fracture properties, 15:48343 (BA;US)
Synthesis of studies for the potential of fault rupture at the proposed surface facilities, Yucca Mountain, Nevada, 15:48309 (BA;US)
The application of vertical seismic profiling and cross-hole tomographic imaging for fracture characterization at Yucca Mountain, 15:48330 (BA;US)
The international Stripa project: Technology transfer from cooperation in scientific and technological research on nuclear waste disposal, 15:48334 (BA;US)

Social Impact
Current social systems issues in the U.S. high level waste management program, 15:48322 (BA;US)
Socio-Economic Factors
Managing local socioeconomic impacts through project management policies concerning subsidized transportation, site access, and on-site housing, 15:48313 (BA;US)
Source Terms
A gas-flow source term from a nuclear waste container in an unsaturated medium, 15:48380 (BA;US)
Start-Up
DOE-EM/producers strategy for wasteform and process startup acceptance, 15:48326 (BA;US)
Thermodynamics
Evaluation of near-field thermal environment conditions for a spent fuel repository in tuff, 15:48320 (BA;US)
Waste Water
Computed distributions of residual shaft drilling and drift construction water in the exploratory facilities at Yucca Mountain, Nevada, 15:48349 (BA;US)

RADIOACTIVE WASTE MANAGEMENT
A demonstration of the systems integration modeling system (SIMS) as a decision-support tool, 15:48328 (BA;US)
A literature-based preliminary characterization of risks in the nuclear waste management system, 15:48386 (BA;US)
A proposed methodology for validating performance assessment models for the DOE Office of Civilian Radioactive Waste Management Program, 15:48318 (BA;US)
A systems engineering cost analysis capability for use in assessing nuclear waste management system cost performance, 15:48364 (BA;US)
Assuring data quality for use in waste management system trade-offs studies, 15:48360 (BA;US)
DOE perspectives on the regulatory framework of the civilian radioactive waste management program, 15:48303 (BA;US)
Environmental impact assessment for a radioactive waste facility: A case study, 15:48259 (R;US)
Evaluating and controlling the characteristics of the nuclear waste in the FWMS using waste stream analysis model, 15:48366 (BA;US)
Hanford Site radioactive solid waste acceptance criteria, 15:48292 (R;US)
High level radioactive waste management: Volume 1, 15:48295 (B;US)
Identification and estimation of socioeconomic impacts resulting from perceived risks and changing images: An annotated bibliography, 15:48255 (R;US)
Important factors in developing a nuclear waste management system, 15:48350 (BA;US)
NUHOMS modular spent-fuel storage system: Design, licensing and construction, 15:48233 (R;US)
Opportunities, 15:48356 (BA;US)
Public involvement: Keystone to public confidence in the civilian radioactive waste management program, 15:48377 (BA;US)
Systems integration operations/logistics model (SOLMOD), 15:48365 (BA;US)
The coordination of system representation and operating assumptions for system studies in SIMS, 15:48358 (BA;US)
The systems integration modeling system, 15:48367 (BA;US)
Waste Isolation Pilot Plant site specific plan: Revision 2, 15:48260 (R;US)

RADIOACTIVE WASTE STORAGE
See also MONITORED RETRIEVABLE STORAGE
Nuclear Technology Programs semiannual progress report, October 1987–March 1988, 15:48729 (R;US)
Reactor operating waste-disposal program: 1989 progress report, 15:48285 (R;CA)
Thorium handling environmental assessment, Feed Materials Production Center, Fernald, Ohio, 15:48262 (R;US)

RADIOACTIVE WASTES
See also ALPHA-BEARING WASTES
HIGH-LEVEL RADIOACTIVE WASTES
LOW-LEVEL RADIOACTIVE WASTES
RADIOACTIVE EFFLUENTS
A gas-flow source term from a nuclear waste container in an unsaturated medium, 15:48380 (BA;US)
Accident analysis in fulfillment of the requirements of the national environmental policy act and their relationship to the packaging and testing requirements of the Nuclear Regulatory Commission, 15:48385 (BA;US)
Characteristics of potential repository wastes, 15:48361 (BA;US)
Defining the need for and functions of the monitored retrievable storage (MRS) facility, 15:48327 (BA;US)
Development of transportation operations requirements: Operations planning, 15:48238 (BA;US)
Diffusion barrier transport properties of unsaturated paintbrush tuff rubble backfill, 15:48314 (BA;US)
Examples of robots and teleoperators at the Savannah River Site, 15:49175 (J;US)
Final response to BDAT related comments document. Mixed radioactive hazardous wastes, polynuclear aromatic u wastes, halogenated aliphatic U wastes, non-halogenated aromatic U wastes, F002-f006, F019. Volume 1-J, 15:49525 (R;US)
Final response to BDAT related comments document. Volume 1A-1. General BDAT issues, 15:49577 (R;US)
Final response to BDAT related comments document: General BDAT issues. Volume 1-A-2, 15:49516 (R;US)
Mass transport in bedded salt and salt interbeds, 15:48304 (BA;US)
Multimedia Environmental Pollutant Assessment System (MEPAS) application guidance: Volume 1, User's guide, 15:49548 (R;US)
Multimedia Environmental Pollutant Assessment System (MEPAS) application guidance: Volume 2, Guidelines for evaluating MEPAS input parameters, 15:49583 (R;US)
Radioactive materials packaging standards and regulations: Making sense of it all, 15:48236 (BA;US)
Recent results of the effects of gamma radiation on the durability and microstructure of DWPF glass, 15:48982 (BA;US)
Simulation modeling of subsurface development, 15:48324 (BA;US)
State of Nevada nuclear waste shipping cask design studies, 15:49173 (BA;US)
The transportation operations system: A description, 15:48237 (BA;US)
Yucca Mountain Project far-field sorption studies and data needs, 15:48284 (R;US)

RADIOCARBON DATING
See CARBON 14

RADIOCHEMISTRY
Radiochemistry Division: annual progress report: 1987, 15:49147 (R;IN)

RADIODIAGNOSIS (RADIONUCLIDES)
See NUCLEAR MEDICINE

RADIOFREQUENCY SYSTEMS
See RF SYSTEMS

RADIOGRAPHY (BIOMEDICAL)
See BIOMEDICAL RADIOGRAPHY

RADIOISOTOPE HEAT SOURCES
Galileo light-weight radioisotope heater units design and safety analysis, 15:48408 (R;US)

RADIOISOTOPE MIGRATION
See RADIONUCLIDE MIGRATION

RADIOISOTOPE-LABELLED DRUGS
See RADIOPHARMACEUTICALS

RADIOISOTOPES
Chemical data bases for the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1, 15:49151 (R;US)
Simulation of radionuclide retardation at Yucca Mountain using a stochastic mineralogical/geochemical model, 15:48308 (BA;US)
Some thoughts on opportunities with reactions using radioactive beams, 15:50023 (R;US)
Yucca Mountain Project far-field sorption studies and data needs, 15:48284 (R;US)

RADIOLOGICAL PROTECTION
See RADIATION PROTECTION

RADIOLOGY
See also BIOMEDICAL RADIOGRAPHY
RADIOTHERAPY
Annual report of National Institute of Radiological Sciences, April 1986 - March 1987, 15:50204 (R;JP)
Annual report of National Institute of Radiological Sciences, April 1987 - March 1988, 15:50205 (R;JP)

RADIONUCLIDE MIGRATION
Assessment of the agricultural implications of land burial of radioactive wastes: soil processes, 15:48256 (R;GB)
CEC project Mirage - Second phase on migration of radionuclides in the geosphere: Second summary progress report (Work period 1988), 15:49734 (R;FR)
CEQCSY: a new code for chemical equilibrium calculation in multiphased systems, 15:48273 (R;FR;In French)
Determination of diffusion coefficients in cohesive and sandy sediment from the area of Gorleben, 15:49597 (RA;DE;In German)
Geochemical modelling of the Broubster natural analogue site Caithness, Scotland, 15:48275 (R;FR)
Incorporation of experimental data, review and documentation of the SPADE database, 15:49711 (R;GB)
Investigation of the potential of fuzzy sets and related approaches for treating uncertainties in radionuclide transfer predictions, 15:48280 (R;FR)
Investigations on the diffusion of inorganic pollutants in selected sediments from the Asse cap rock and in clay samples from the Niederwallach landfill, 15:49459 (RA;DE;In German)
Reactor operating waste-disposal program: 1989 progress report, 15:48285 (R;CA)
Setting up and experimental validation of the coupling between a geochemical model and a transport model of dissolved elements, 15:48271 (R;FR;In French)

RADIONUCLIDE TRANSFER (IN ENVIRONMENT)
See RADIONUCLIDE MIGRATION

RADIONUCLIDES
See RADIOISOTOPES

RADIOPHARMACEUTICALS
Nuclear medicine and imaging research (quantitative studies in radiopharmaceutical science): Progress report, January 1–September 1, 1990, 15:49688 (R;US)
Nuclear medicine and quantitative imaging research (instrumentation and quantitative methods of evaluation): Progress report, January 15–September 1, 1990, 15:49687 (R;US)

RADIOPROTECTIVE SUBSTANCES
Mechanism of action of radiation-protective agents: In-vivo distribution and metabolism of cysteamine-S-phosphate (MEAP). Annual report, 1 July 1968-30 June 1969, 15:49709 (R;US)
Preparation of potential radioprotective agents derived from aminothiols. Annual report, 16 July 1985-15 July 1986, 15:49706 (R;US)

RADIOSURGERY
See RADIOTHERAPY

RADIOTHERAPY
Results and hazards of postoperative radiotherapy using orthovoltage (300 kV) in carcinomas of the breast, 15:49690 (R;DE;In German)

RADIOWAVE RADIATION
Radiofrequency radiation in the workplace, 15:49728 (R;CA)

RADIUM 226
Results of the radiological survey at the Granite City Steel faciltiy, Granite City, Illinois, 15:49575 (R;US)

RADIUM 228
Results of the radiological survey at the Granite City Steel faciltiy, Granite City, Illinois, 15:49575 (R;US)

RADON
A study of radon variation in dwelling during 1988, 15:50062 (R;IN)
An overview of instrumentation for measuring environmental radon and radon progeny, 15:49562 (J;US)
Indoor air quality in New Brunswick homes: Radon and radon daughters, 15:49464 (R;CA)
Radon, 15:48798 (BA;US)
Radon I: Sources and assessment, 15:48800 (BA;US)
Radon II: Mitigation, 15:48801 (BA;US)
Radon overview, 15:48799 (BA;US)
Radon-removal techniques for small community public water supplies, 15:49633 (R;US)
Task Order 2 enhanced preliminary assessment, Fort Douglas, Salt Lake City, Utah. Final report, October-December 1989, 15:49416 (R;US)
Testing of indoor radon-reduction techniques in 19 Maryland houses. Final report, January 1987-June 1989, 15:49531 (R;US)

RADON 220
Simulation of alpha continuous air monitor alarm response in the presence of plutonium, 15:49557 (R;US)

RADON 222
Biological sources and sinks of methane in tropical habitats and tropical atmospheric chemistry. Doctoral thesis, 15:49532 (R;US)

RADON ISOTOPES
See also RADON 220
RADON 222
Simulation of alpha continuous air monitor alarm response in the presence of plutonium, 15:49557 (R;US)

RAILGUN ACCELERATORS
Railgun performance with a two-stage light-gas gun injector: Revision 1, 15:49167 (R;US)

RAINOUT
See WASHOUT

RAMAN SPECTROSCOPY
An apparatus for studies of hydrogen isotope exchange over metals using laser-Raman spectroscopy, 15:48998 (R;US)
Raman studies of surface processes, 15:49075 (RA;US)

RARE EARTH ALLOYS
Growth and deformation mechanisms of refractory-alloy hybrid materials. Final report, September 1986-September 1989, 15:48903 (R;US)
Metallurgical processes in multi-component rare earth-transition metal permanent magnet alloys. Final report, 15 May 1987-14 May 1990, 15:48854 (R;US)

RATS
"In vitro" and "in vivo" studies 2,6 - diisopropyl-fenil-carboilmethyl iminodiacetic acid labeled with ^{99m}Tc (Disida -^{99m}Tc), 15:49713 (R;BR;In Portuguese)

RAYLEIGH-TAYLOR INSTABILITY
Evidence of Rayleigh-Taylor instabilities in tri-layer targets, 15:50166 (R;FR)

RBMK TYPE REACTORS
See LWGR TYPE REACTORS

RBMK-1500 REACTOR
See IGNALINSK-1 REACTOR

REACTOR ACCIDENTS
See also DESIGN BASIS ACCIDENTS
LOSS OF COOLANT
MELTDOWN
CORQUENCH: A model for gas sparging-enhanced melt-water, film boiling heat transfer, 15:48644 (R;US)
Emergency operating procedures for SGTR sequence, 15:48552 (RA;XA)
Information on economic and social consequences of the Chernobyl accident, 15:48652 (R;XA)
The lessons drawn from accident simulation, consequences for the operation of the Crisis Technical Center of the Nuclear Safety and Protection Institut, 15:48639 (R;FR;In French)

REACTOR CHARGING MACHINES
Wind force measurement on a model fuelling-machine trolley in a simulated LOCA, 15:48661 (R;CA)

REACTOR COMPONENTS
See also BREEDING BLANKETS
CONTROL ELEMENTS
FUEL ELEMENTS
REACTOR CHARGING MACHINES
REACTOR COOLING SYSTEMS
REACTOR CORES
SPERT-II benchmarks of a dynamic model for the advanced neutron source reactor, 15:48671 (J;US)
The HFR as research tool. Operation, maintenance and upgrading, 15:48623 (RA;FR)

REACTOR CONTROL RODS
See CONTROL ELEMENTS
REACTOR COOLING SYSTEMS
BWR [Boiling Water Reactor] Owners Group Intergranular Stress Corrosion Cracking Research Program: Executive summary: Phase 2 (1984–1988): Final report, 15:48528 (R;US)
Development of a detailed core flow analysis code for prismatic fuel reactors, 15:48572 (R;US)
Measurement of two-phase flow momentum with force transducers, 15:48645 (R;US)
Post-test analysis of natural circulation, flow coastdown, and pressurizer spray tests in a large four loop PWR using RELAP5/MOD2, 15:48553 (RA;XA)
Practical application of passive safety features for the advanced neutron source cooling system, 15:48642 (R;US)
Present status of heat transfer in narrow gap rectangular channel, 15:49185 (RA;JP;In Japanese)
Proceedings of the third International Atomic Energy Agency specialist's meeting on subcritical crack growth: Opening session and Technical session 1, 15:48537 (R;US)
Scaling of two-phase flow regimes in a rod bundle with freon, 15:48658 (R;US)
The GRS thermalhydraulic system code ATHLET, 15:48533 (RA;XA)
The effect of dissolved zinc on the transport of corrosion products in PWRs: Final report, 15:48544 (R;US)
Thermal-hydraulic impact of failure of highly irradiated fuel pins on LMR passive safety, 15:48641 (R;US)
REACTOR CORES
Analysis of inhomogeneities of reactor fuel assemblies using statistics criteria, 15:48596 (R;SU;In Russian)
TRECD program for three-dimensional calculation of a heterogeneous reactor in dipole approximation, 15:48597 (R;SU;In Russian)
REACTOR DISMANTLING
Adaptation of high pressure water jets with abrasives for nuclear installations dismantling, 15:48651 (R;FR;In French)
REACTOR FUEL ELEMENTS
See FUEL ELEMENTS
REACTOR FUELS
See NUCLEAR FUELS
REACTOR KINETICS EQUATIONS
TEMP-8 module. Calculation of reactor point kinetics with increased accuracy, 15:48595 (R;SU;In Russian)
REACTOR LICENSING
Enforcement actions: Significant actions resolved: Quarterly progress report, April–June 1990, 15:48591 (R;US)
Nuclear regulatory commission issuances, 15:48590 (R;US)
REACTOR MATERIALS
See also NUCLEAR FUELS
Flaw assessment procedure for high temperature reactor components, 15:48580 (R;US)
Proceedings of the third International Atomic Energy Agency specialist's meeting on subcritical crack growth: Opening session and Technical session 1, 15:48537 (R;US)
Proceedings of the third International Atomic Energy Agency specialists' meeting on subcritical crack growth: Technical sessions 2, 3, and 4 and Recommendations and conclusions Session 5, 15:48538 (R;US)
Recommendations for the shallow-crack fracture toughness testing task within the HSST [Heavy-Section Steel Technology] Program, 15:48571 (R;US)
Research activities related to nuclear power plant ageing in the Federal Republic of Germany, 15:48525 (RA;XA)
REACTOR MONITORING SYSTEMS
An integrated operator advisor system for plant monitoring, procedure management, and diagnosis, 15:48614 (J;US)
Sensor validation for power plants using adaptive backpropagation neural network, 15:48616 (J;US)
Validating data from instruments in harsh environments: The designer's dilemma, 15:48615 (J;US)
REACTOR SAFETY
An analysis of containment venting as a severe accident mitigation strategy for the BWR Mark II containment, 15:48670 (J;US)
An integrated operator advisor system for plant monitoring, procedure management, and diagnosis, 15:48614 (J;US)
Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48653 (R;XA)
Inherently safe characteristics of nuclear reactors, 15:48532 (R;FR)
Nuclear safety in France, 15:48542 (R;FR)
Validating data from instruments in harsh environments: The designer's dilemma, 15:48615 (J;US)
REACTOR SITES
Pre-operational external radiation monitoring in NAPP environs using TLDs (Jan 1987 - Mar 1989), 15:50061 (R;IN)
REACTOR SITING
See SITE SELECTION
REACTOR VESSELS
Recommendations for the shallow-crack fracture toughness testing task within the HSST [Heavy-Section Steel Technology] Program, 15:48571 (R;US)
RECEIVERS (SOLAR)
See SOLAR RECEIVERS
RECIPROCAL TRANSLOCATIONS
See CHROMOSOMAL ABERRATIONS
RECTUM
The role of CT In follow-up treatment of patients after proctectomy due to a carcinoma: A retrospective study of 93 patients, 15:49691 (R;DE;In German)
RECYCLE (FUEL)
See FUEL CYCLE
RECYCLING
Awareness and participation levels in high-rise apartment building recycling programs, 15:48832 (RA;CA)
RED SHIFT
Galaxies, 15:49835 (RA;ZA)
REDUCTASES
See OXIDOREDUCTASES
REFERENCE MATERIALS (STANDARD)
See CALIBRATION STANDARDS
REFRACTORIES
Growth and deformation mechanisms of refractory-alloy hybrid materials. Final report, September 1986-September 1989, 15:48903 (R;US)
REFRIGERANTS
Thermal performance analysis for heat exchangers using nonazeotropic refrigerant mixtures, 15:48772 (R;US)
Tubeside evaporation of nonazeotropic refrigerant mixtures from two enhanced surfaces, 15:48773 (R;US)
REFUSE
See SOLID WASTES
REFUSE-FUELED POWER PLANTS
Economic utilization of landfill gas from small and medium-sized waste dumps: Demonstration project: Final report, 15:48829 (R;LU;In English, German)
REGION I
See FEDERAL REGION I
REGION III
See FEDERAL REGION III
REGION IV
See FEDERAL REGION IV
REGION IX
See FEDERAL REGION IX
REGION V
See FEDERAL REGION V
REGION VI
See FEDERAL REGION VI
REGION VII
See FEDERAL REGION VII
REGION VIII
See FEDERAL REGION VIII
REGION X
See FEDERAL REGION X
REGULATIONS
Hanford Site radioactive solid waste acceptance criteria, 15:48292 (R;US)

REINDEER
See DEER

REINFORCED CONCRETE
Effectiveness of concrete to protect steel reinforcement from corrosion in marine structures, 15:49195 (R;GB)

REINFORCED MATERIALS
See also REINFORCED CONCRETE
Fracture resistance behavior of silicon carbide whisker-reinforced alumina composites with different porosities, 15:48942 (J;US)

RELEASE (FISSION PRODUCT)
See FISSION PRODUCT RELEASE

REMEDIAL ACTION
Environmental impact assessment for a radioactive waste facility: A case study, 15:48259 (R;US)

RENEWABLE ENERGY SOURCES
See also BIOMASS
GEOTHERMAL ENERGY
HYDROELECTRIC POWER
WAVE POWER
How renewable fuels contribute to clean air, 15:48440 (RA;CA)

RENEWABLE RESOURCES
Vester Nebel combined collective heat supply system: Demonstration project: Final report, 15:48828 (R;LU)

RESEARCH REACTORS
See also HFR REACTOR
JRR-3 REACTOR
Experimental studying the altitude distribution of the $^{63}Cu(n,\gamma)$ reaction rates in the model of the TVR-M reactor core, 15:48627 (R;SU;In Russian)
Experimental studying the azimuthal-radial distributions of the $^{63}Cu(n,\gamma)$ reaction rates in the model of the TVR-M reactor core, 15:48628 (R;SU;In Russian)
Experimental studying the effects of horizontal experimental channels on the neutron field in the model of the TVR-M research reactor core, 15:48629 (R;SU;In Russian)
Practical application of passive safety features for the advanced neutron source cooling system, 15:48642 (R;US)
Present status and subjects of ultrahigh neutron flux reactors in USA, 15:48632 (RA;JP;In Japanese)
The Neutron Radiography Reactor (NRAD), 15:48620 (R;US)

RESID
See PETROLEUM RESIDUES

RESIDENCES
See HOUSES

RESIDENTIAL BUILDINGS
See also HOUSES
Affordable comfort III program, 15:48797 (B;US)
The development of an integrating tracer gas method for ventilation measurements, 15:48796 (R;FI;In Finnish)

RESIDUAL OILS
See PETROLEUM RESIDUES

RESIDUES (RADIOACTIVE)
See RADIOACTIVE WASTES

RESINS
Solidification in cement of ion-exchange resins from LOMI [Low Oxidation State Metal Ion] decontamination: Final report, 15:48269 (R;US)
Volume reduction of ion exchange resins by catalytic incineration, 3: Investigation of overall reaction rate, 15:48283 (R;JP;In Japanese)

RESONANCE IONIZATION MASS SPECTROSCOPY
Applications of diode lasers to resonance ionization mass spectrometry, 15:49870 (R;US)

RESONANCE STATES
See ENERGY LEVELS

RESOURCE DEVELOPMENT
Optimal arrangement of hydroelectric power systems, 15:48449 (RA;CA)
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): Striped bass, 15:49588 (R;US)

RESOURCE RECOVERY FACILITIES
Economic utilization of landfill gas from small and medium-sized waste dumps: Demonstration project: Final report, 15:48829 (R;LU;In English, German)
Recycling of electric-arc-furnace dust, 15:48824 (R;US)

RESPIRABLE DUSTS
See DUSTS

RESPIRATORS
Respirator standards, regulations, and approvals in the USA, 15:49168 (R;US)

RESPIRATORY EQUIPMENT
See RESPIRATORS

RESPIRATORY SYSTEM
See also LUNGS
Acid air pollutant mixtures: Respiratory system responses and effects of exercise, 15:49720 (R;US)
Biological effects of combined exposure to coal fly ash and nitrogen dioxide. 3.: Morphological changes in respiratory organs of golden hamster, 15:48122 (R;JP;In Japanese)
Inhalation toxicology of combined acid and soot particles. Final report, 15:49719 (R;US)
Nitrogen dioxide and respiratory infection: Pilot investigations. Research report, January 1984-September 1987, 15:49536 (R;US)

RETORTED SHALES
See SPENT SHALES

REVEGETATION
Reuse of incinerated soil residues in land reclamation, 15:49567 (R;US)

REVERSE-FIELD PINCH
Confinement and fluctuations in the MST [Madison Symmetric Torus] reversed field pinch, 15:50115 (R;US)

RF SYSTEMS
The development and tests of high-power Y-circulator of the metre-wave range, 15:49253 (R;SU;In Russian)

RHO-1500 RESONANCES
See MESONS

RHO-1700 RESONANCES
See MESONS

RHODE ISLAND
Health assessment for Rose Hill Regional Landfill, South Kingstown, Rhode Island, Region 1. CERCLIS No. RID980521025. Preliminary report, 15:49622 (R;US)

RHODIUM COMPLEXES
High pressure NMR spectroscopy studies: The regioselective hydrogenation mechanism of polynuclear heteroaromatic nitrogen compounds with $Cp^*Rh(CH_3CN)_3^{2+}$ as a catalyst precursor, 15:48082 (BA;US)
Transition metal-catalyzed conversion of CO, NO, H_2, and organic molecules to fuels and petrochemicals, 15:49001 (RA;US)

RIBULOSE DIPHOSPHATE CARBOXYLASE
Mild water stress effects on carbon-reduction-cycle intermediates, ribulose bisphosphate carboxylase activity, and spatial homogeneity of photosynthesis in intact leaves, 15:48465 (J;US)

RICHLAND NPR REACTOR
See N-REACTOR

RIGHTS-OF-WAY
First year results of revegetation trials using selected native plant species on a simulated pipeline trench, Fort Norman, N.W.T., Canada, 15:48162 (RA;CA)
Productivity of agronomic and native plants under various fertilizer and seed application rates on a simulated transport corridor, Fort Norman, Northwest Territories, 15:49635 (RA;CA)
The use of cover crops for the maintenance of rights-of-way vegetation: A survey of the literature on succession, cover crops competition and trees, 15:48677 (R;CA)

RINGS (STORAGE)
See STORAGE RINGS

RISER CRACKING
See COAL LIQUEFACTION

ROADWAYS (MINES)
See MINE ROADWAYS

ROBOTS
An expert system for automated robotic grasping, 15:49164 (R;US)
Development of a small gantry robotic workcell for deoxyribonucleic acid (DNA) filter array construction, 15:49644 (R;US)
Robotic inspection of prototype titanium diffusion-bond final-closure weld: Final report, 15:48235 (R;CA)
Robotic requirements for plutonium handling automation, 15:49176 (J;US)
[Mobile robots and intelligent motion control]: Foreign trip report, August 18, 1990–August 25, 1990, 15:49163 (R;US)

ROCK SALT
See SALT DEPOSITS

ROCKETS
Tethered rocket as a vehicle for penetration and impact testing: Development report, 15:49393 (R;US)

ROCKS
See also IGNEOUS ROCKS
Rock mechanics aspects of the ESF design, 15:48301 (BA;US)

ROCKY MOUNTAIN REGION
See FEDERAL REGION VIII

RODS (CONTROL)
See CONTROL ELEMENTS

RODS (FUEL)
See FUEL RODS

RUBIDIUM
Collisional and electric-field ionization of laser-prepared Rydberg states in an ion trap mass spectrometer, 15:49872 (R;US)

RUBIDIUM NITRATES
Structure of rubidium uranyl(VI) trinitrate, 15:49014 (RA;US)

RUBIDIUM URANATES
Structure of rubidium uranyl(VI) trinitrate, 15:49014 (RA;US)

RUNOFF
Red Canyon wash infiltration studies, 15:49592 (R;US)

RUTHENIUM
Improved Fischer-Tropsch Synthesis catalysts for indirect coal liquefaction: Quarterly technical progress report No. 8, 1 July–30 September 1987, 15:48075 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 8, April 1, 1989–June 30, 1989, 15:48510 (R;US)

RUTHENIUM COMPLEXES
Intramolecular electron transfer rates: Three year progress report, 15:49124 (R;US)
Long range electron-transfer beyond 20Å across rigid polypeptide bridges, 15:49648 (BA;US)
The chemistry of (fulvalene)-molybdenumruthenium(pentacarbonyl), 15:49054 (RA;US)

RUTHENIUM OXIDES
Simultaneous particulates, NOx_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 9, July 1, 1989–September 30, 1989, 15:48511 (R;US)

RYDBERG STATES
Collisional and electric-field ionization of laser-prepared Rydberg states in an ion trap mass spectrometer, 15:49872 (R;US)

S

S CODES
Incorporation of experimental data, review and documentation of the SPADE database, 15:49711 (R;GB)
Systems integration operations/logistics model (SOLMOD), 15:48365 (BA;US)

S-1000 RESONANCES
See MESONS

SACLAY SYNCHROTRON
See SATURNE

SAFETY
See also REACTOR SAFETY
Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48653 (R;XA)
IAEA activities in computer aided safety analysis, 15:48519 (RA;XA)
Safety of the advanced WWER-1000 in condition of failure of the emergency protection system, 15:48554 (RA;XA)

SAFETY (NUCLEAR)
See RADIATION PROTECTION

SAFETY (REACTOR)
See REACTOR SAFETY

SAFETY ENGINEERING
Present status and subjects of research on safety design of medium and small size power reactors, 15:48598 (RA;JP;In Japanese)

SAFETY RODS
See SCRAM RODS

SAINT LAWRENCE RIVER
See ST LAWRENCE RIVER

SALINE ZONE
See OIL SHALES

SALT DEPOSITS
Mass transport in bedded salt and salt interbeds, 15:48304 (BA;US)
Retention capacity of rock salt. Final report, 15:48289 (R;DE;In German)

SAMARIUM COMPLEXES
On the stability and bonding in bis(η-arene)lanthanide complexes, 15:49063 (RA;US)

SAMPLE HOLDERS
Ultrahigh-vacuum apparatus for surface spectroscopy and characterization at cryogenic temperatures, 15:49282 (RA;US)

SAND
A statistical comparison of uplift design methods for augered footings in sand, 15:48970 (R;CA)
Design criteria for produced sand injection facilities, 15:48205 (RA;CA)

SANDIA LABORATORIES
Isotope geochemistry: A critical component of energy research, 15:49739 (R;US)

SANITARY LANDFILLS
Economic utilization of landfill gas from small and medium-sized waste dumps: Demonstration project: Final report, 15:48829 (R;LU;In English, German)
Nonradioactive dangerous waste landfill closure/postclosure plan, 15:48263 (R;US)

SAPPHIRE
High energy iron ion implantation into sapphire, 15:50069 (R;US)

SASKATCHEWAN
Bacterial evaluation of the biopolymer selective plugging field test at Standard Hill, Saskatchewan, 15:48132 (R;CA)
Chemical use and distribution in the Regina aquifer region. Volume I: Executive Summary – Volume II: Report and appendices, 15:49602 (R;CA)
Saskatchewan Energy and Mines annual report, 1988-89, 15:48728 (R;CA)
Saskoil annual report 1988, 15:48144 (R;CA)

SATURNE
Isotopical separation of relativistic projectile fragments, first experiments at SATURNE, 15:50006 (RA;FR)

SAVANNAH RIVER PLANT
Examples of robots and teleoperators at the Savannah River Site, 15:49175 (J;US)
High level radioactive waste management at the Savannah River Site, 15:48329 (BA;US)
Soluble high-level waste decontamination and disposal at the Savannah River Site, 15:48352 (BA;US)

SAVANNAH RIVER PLANT L REACTOR
See L REACTOR

SCALAR FIELDS
Separable coordinates and particle creation III: Accelerating, Rindler and Milne vacua, 15:49962 (R;BR)

SCANNERS (IMAGE)
See IMAGE SCANNERS

SCANNING ELECTRON MICROSCOPY
Interfacing a personal computer to an analog scanning electron microscopy for storing images on optical disks, 15:50235 (R;US)
SCATTERING AMPLITUDES
Amplitude analysis of $\gamma\gamma \rightarrow \pi\pi$ from threshold to 1.4 GeV, 15:49957 (R;GB)
SCAVENGING (ATMOSPHERIC)
See WASHOUT
SCHNELLER NATRIUMGEKUEHLTER REAKTOR
See SNR REACTOR
SCHROEDINGER EQUATION
Accuracy-weighted variational principle for degenerate continuum states, 15:50192 (RA;GB)
SCHWINGER TERMS
On the origin of the Schwinger anomaly, 15:49970 (R;SU)
SCIENTIFIC PERSONNEL
Co-researches with researchers of alternative energy of petroleum in EC countries, 15:48730 (R;JP;In Japanese)
Interchange of researchers on alternative energy of petroleum in EC countries, 15:48732 (R;JP;In Japanese)
Invitation business of experts in alternative energy, 15:48731 (R;JP;In Japanese)
SCINTILLATION CHAMBERS
See SCINTILLATION COUNTERS
SCINTILLATION COUNTERS
See also GAS SCINTILLATION DETECTORS
SOLID SCINTILLATION DETECTORS
New scintillation materials for high energy physics applications, 15:49329 (J;US)
SCINTILLATION DETECTORS
See SCINTILLATION COUNTERS
SCRAM RODS
HTR components irradiation tests. Actual state and future requirements, 15:48634 (RA;FR;In German)
SCRAP METALS
Decontamination and decommissioning facility environmental assessment, Feed Materials Production Center, Fernald, Ohio, 15:48261 (R;US)
SCRUBBERS
On the removal of mercury from flue-gas scrub solutions by cementation, 15:48096 (R;DE)
SEAS
See also PACIFIC OCEAN
Direct determination of nitrification in marine waters by using the short-lived radioisotope of nitrogen, ^{13}N, 15:49639 (J;US)
SEBACEOUS GLANDS
See SKIN
SECONDARY BATTERIES
See ELECTRIC BATTERIES
SECONDARY BEAMS
Heavy ion secondary beam course, 15:49264 (RA;JP;In Japanese)
SECONDARY RECOVERY
See ENHANCED RECOVERY
SEDIMENTS
General design memorandum, Gulfport Harbor, Mississippi. Design Memorandum Number 1. Appendix E. Thin-layer disposal. Final report, 15:49587 (R;US)
Health assessment for Fletcher's Paint Works and Storage Facility Hazardous Waste Material, Milford, Hillsborough County, New Hampshire, Region 1. CERCLIS No. NHD981067614. Preliminary report, 15:49615 (R;US)
Health assessment for Imperial Oil Co., Inc./Champion Chemicals, Marlboro Township, Monmouth County, New Jersey, Region 2. CERCLIS No. NJD980654099. Final report, 15:49624 (R;US)
Health assessment for Occidental Chemical Corporation Site, Lower Pottsgrove Township, Montgomery County, Pennsylvania, Region 3. CERCLIS No. PAD980229298. Preliminary report, 15:49623 (R;US)
Health assessment for South Municipal Water Supply Well, Hillsborough County, Peterborough, Cheshire County, New Hampshire, Region 1. CERCLIS No. NHD980671069. Final report, 15:49616 (R;US)
Health assessment for Tri-City Industrial Disposal Site, Brooks, Kentucky, Region 4. CERCLIS No. KYD981028350. Preliminary report, 15:49619 (R;US)
Health assessment for Union Carbide Disposal/Red Oak Landfill Site, Red Oak, Iowa, Region 7. CERCLIS No. IAD980643509. Preliminary report, 15:49539 (R;US)
Investigations on the diffusion of inorganic pollutants in selected sediments from the Asse cap rock and in clay samples from the Niederwallach landfill, 15:49459 (RA;DE;In German)
Superfund Record of Decision (EPA Region 3): C and R Battery, VA. (First remedial action), March 1990. Final report, 15:49629 (R;US)
SEISMIC DETECTORS
Stability of RMS Lg measurements and their potential for accurate estimation of the yields of Soviet underground nuclear explosions. Technical report, November 1989-31 January 1990, 15:49402 (R;NO)
SELENIUM COMPOUNDS
See also SELENIUM SULFIDES
Final best demonstrated available technology (BDAT) background document for K031, K084, K101, K102, characteristic arsenic wastes (D004), characteristic selenium wastes (D010), and P and U wastes containing arsenic and selenium listing constituents. Volume 1, 15:49475 (R;US)
SELENIUM SULFIDES
Picosecond studies of the electron-hole pair dynamics in CdS_xSe_{1-x} graded semiconductors, 15:48961 (RA;US)
SEM (MICROSCOPY)
See SCANNING ELECTRON MICROSCOPY
SEMICONDUCTOR DEVICES
See also SEMICONDUCTOR LASERS
TRANSISTORS
Implementation of a QML (Qualified Manufacturer's List) methodology for discrete semiconductors, 15:48977 (R;US)
Ultra-fast voltage comparators for transient waveform analysis, 15:50246 (J;US)
SEMICONDUCTOR JUNCTIONS
See also HETEROJUNCTIONS
Efficient photovoltaic devices for InP semiconductor/liquid junctions. Technical report, 15:48454 (R;US)
SEMICONDUCTOR LASERS
Applications of diode lasers to resonance ionization mass spectrometry, 15:49870 (R;US)
SEMICONDUCTOR MATERIALS
Compositional imaging of semiconductor interfaces by Z-contrast scanning transmission electron microscope (STEM), 15:48952 (R;US)
High-energy oxidizers and delocalized-electron solids, 15:49097 (RA;US)
Infrared absorption study of neutron-transmutation-doped germanium, 15:49074 (RA;US)
Light-heavy-hole-mixing-induced selection rules for magnetoluminescence and valence-band energy dispersion in semiconductor quantum wells, 15:49892 (R;US)
Picosecond charge-transfer events in the photosensitization of colloidal TiO_2, 15:48983 (J;US)
Picosecond studies of the electron-hole pair dynamics in CdS_xSe_{1-x} graded semiconductors, 15:48961 (RA;US)
Semiconductor materials and devices, 15:49073 (RA;US)
Study of the fundamental linewidths of $1S \rightarrow nP$ donor transitions in ultrapure germanium, 15:48966 (RA;US)
Work in progress, 15:48928 (RA;US)
SENIOR CENTERS
See PUBLIC BUILDINGS
SEPARATION PROCESSES
See also CHROMATOGRAPHY
ISOTOPE SEPARATION
Nuclear Technology Programs semiannual progress report, October 1987–March 1988, 15:48729 (R;US)
SEQUESTRENE
See EDTA

SEQUOYAH NUCLEAR POWER PLANT UNIT-1
See SEQUOYAH-1 REACTOR

SEQUOYAH-1 REACTOR
Radionuclide release calculations for selected severe accident scenarios: Supplemental calculations, 15:48663 (R;US)

SHAFT EXCAVATIONS
A description and status of the Yucca Mountain Project repository sealing program, 15:48323 (BA;US)
Computed distributions of residual shaft drilling and drift construction water in the exploratory facilities at Yucca Mountain, Nevada, 15:48349 (BA;US)
Concepts in prototype testing for in situ geomechanical investigations at Yucca Mountain, 15:48333 (BA;US)
Prelimary methodology for design of stable drifts for the Yucca Mountain Project, 15:48297 (BA;US)
Prototype heater test of the environment around a simulated waste package, 15:48332 (BA;US)
Prototype testing for the Yucca Mountain project, 15:48335 (BA;US)
Role of underground testing to determine suitability of Yucca Mountain as a potential repository site, 15:48299 (BA;US)
Smoothwall blasting planned for the underground research facility at Yucca Mountain, 15:48298 (BA;US)
Ventilation design for the Exploratory Shaft Facility Yucca Mountain Project, 15:48376 (BA;US)

SHALE OIL
Testing of New Brunswick oil shale in R.P.C. test facility. Open File Report No. 90-2, 15:48199 (R;CA)

SHAPED CHARGES
Description of a PC-based coupled "PER" theory/finite element method for calculating shaped charge jet characteristics, 15:49394 (R;US)

SHEATHS (FUEL)
See FUEL CANS

SHF RADIATION
See RADIOWAVE RADIATION

SHOCK (IMPACT)
See IMPACT SHOCK

SHOWER COUNTERS
CAD tools for detector design, 15:49293 (R;US)
Can a Pb/SCIFI calorimeter survive the SSC?, 15:49286 (R;US)
Electromagnetic shower calorimeter, 15:49310 (RA;JP;In Japanese)
Parallelization of a radiation transport simulation code on the BBN TC2000™ parallel computer, 15:49285 (R;US)
SSC detector R&D at Brookhaven National Laboratory (BNL): April 1990 Status report, 15:49283 (R;US)
Spatial resolution of electromagnetic liquid krypton calorimeter: Monte-Carlo simulation, 15:49300 (R;SU;In Russian)
Technique for investigation of hadron groups in ionization calorimeter, 15:49288 (R;SU;In Russian)
[An experiment at GSI/SIS to study the 4π detector system]: Foreign trip report, June 9–September 5, 1990, 15:49316 (R;US)

SI SEMICONDUCTOR DETECTORS
A high rate FASTBUS silicon strip readout system, 15:49336 (J;US)
A high speed, high gain preamplifier system for silicon strip detectors, 15:49340 (J;US)
A high speed, low noise ASIC preamplifier for silicon strip detectors, 15:49343 (J;US)
A monolithically integrated detector-preamplifier on high-resistivity silicon, 15:49342 (J;US)
Assessment of TFT amplifiers for a-Si:H PIXEL particle detectors, 15:49356 (J;US)
Design and prototyping of the front end readout system for the CDF silicon vertex detector, 15:49273 (J;US)
Improved charge collection of the buried p-i-n- a-Si:H radiation, 15:49324 (J;US)
Radiation effects on the SVX silicon strip readout chip, 15:49371 (J;US)
Silicon microstrip electronics operating with 20 nsec FWHM signals, 15:49358 (J;US)
Study on the effect of main performance of Si-surface-barrier detectors of different area on the noise and timing parameters of a charged particle spectrometer, 15:49294 (R;SU;In Russian)

SIALON
See ALUMINIUM OXIDES
SILICON NITRIDES

SILICA
Evolution of surface area during the controlled growth of silica spheres, 15:48973 (R;US)

SILICA GEL
Study of the silica aerogel densifications by SAXS and BET, 15:48909 (R;BR;In Portuguese)

SILICON
A theoretical investigation on structural, vibrational, and electronic properties of amorphous silicon, 15:48879 (R;US)
Application of ion beam sputtering for diffusion study in solids, 15:50065 (R;GB)
Currents caused by radiation-induced defects in p-n junctions, 15:50082 (RA;SU;In Russian)
Damped-core quantum Monte Carlo: An effective treatment for large-z systems, 15:50233 (RA;US)
Hydrogen passivation of radiation-induced defects in silicon, 15:50081 (RA;SU;In Russian)
Investigation of radiation-induced defects in p-Si by deep level nonstationary capacitance spectroscopy method, 15:50083 (RA;SU;In Russian)
Residual stress at fluid interfaces, 15:48870 (R;US)
SERI workshop on the role of point defects/defect complexes in silicon device fabrication: Book of abstracts, 15:48461 (R;US)

SILICON ALLOYS
Structure of amorphous-silicon and germanium alloy films: Annual subcontract report, January 15, 1989–January 14, 1990, 15:48463 (R;US)

SILICON CARBIDES
Characterization of short fatigue cracks at notches in SiC particulate aluminum composite, 15:48957 (R;US)
Corrosion protection of metal-matrix composites. Final report, October 1986-April 1990, 15:48855 (R;US)
Effect of hydrogen-water atmospheres on corrosion and flexural strength of sintered α-silicon carbide, 15:48944 (J;US)
Effect of interfacial characteristics on the mechanical performance of ceramic-ceramic composites. Final report, July 1986-December 1989, 15:48906 (R;US)
Fracture resistance behavior of silicon carbide whisker-reinforced alumina composites with different porosities, 15:48942 (J;US)
Investigation of thermo-mechanical effects in silicon carbide whisker/Al alloy composites. Final report, 1 March 1985-31 August 1989, 15:48902 (R;US)
Metal-matrix composites - a promising alternative to conventional alloys, 15:48908 (R;DE)
Short-fibre and particulate-reinforced metal-matrix composites, 15:48907 (R;US)
The chemical state of iron ions implanted into silicon carbide, 15:48950 (R;US)

SILICON NITRIDES
Bonding mechanisms in silicon nitride brazing, 15:48943 (J;US)
Effect of interfacial characteristics on the mechanical performance of ceramic-ceramic composites. Final report, July 1986-December 1989, 15:48906 (R;US)

SILICON OXIDES
See also SILICA
Optical study and analysis of Pu^{4+} in single crystals of $ZrSiO_4$, 15:49020 (RA;US)
Residual stress at fluid interfaces, 15:48870 (R;US)

SILICON SEMICONDUCTOR DETECTORS
See SI SEMICONDUCTOR DETECTORS

SILICON SOLAR CELLS
Research on high-efficiency, large area amorphous silicon based solar cells: Final subcontract report, February 1, 1989–February 28, 1990, 15:48462 (R;US)
Research on high-efficiency, multiple-gap, multi-junction amorphous silicon-based alloy thin-film solar cells: Final subcontract report, March 1, 1987–February 28, 1990, 15:48464 (R;US)

SERI workshop on the role of point defects/defect complexes in silicon device fabrication: Book of abstracts, 15:48461 (R;US)

SILICONES
Thin-film composite materials, Phase 2. Final report, 1 April-31 December 1986, 15:48948 (R;US)

SILVER
Unenhanced surface Raman spectroscopy of nitrogen physisorbed on Ag(111), 15:49076 (RA;US)
Work in progress, 15:49078 (RA;US)
Work in progress, 15:49038 (RA;US)
$YBa_2Cu_3O_x$ composites with improved toughness and strength, 15:48916 (R;US)

SILVER 109
SDIO/1st ultrashort wavelength laser - novel experimental schemes for observing the Moessbauer Effect in long-lived nuclear levels and nuclear coherent states. Final technical report for period ending 26 May 1990, 15:49200 (R;US)

SILVER FLUORIDES
A general method for the synthesis of polymeric binary fluorides exemplified by AgF_3, NiF_4, RuF_4, and OsF_4, 15:49099 (RA;US)

SILVER NITRATES
Fabrication of composite high temperature superconductor wires from $Ag/YBa_2Cu_3O_x$ power produced by $AgNO_3$ decomposition, 15:48901 (R;US)

SIMS
See ION MICROPROBE ANALYSIS
MASS SPECTROSCOPY

SINE GENERATORS
See FUNCTION GENERATORS

SINGLE PHOTON EMISSION COMPUTED TOMOGRAPHY
A high-resolution SPECT system based on a microchannelplate imager, 15:49346 (J;US)
A new generation of SPECT and PET systems based on position sensitive photomultipliers, 15:49363 (J;US)
Constrained least squares filtering in high resolution PET and SPECT imaging, 15:49349 (J;US)
Nuclear medicine and quantitative imaging research (instrumentation and quantitative methods of evaluation): Progress report, January 15–September 1, 1990, 15:49687 (R;US)
Three-dimensional imaging utilizing energy discrimination, 15:49703 (J;US)

SINTERING
Co-researches with researchers of alternative energy of petroleum in EC countries, 15:48730 (R;JP;In Japanese)

SITE CHARACTERIZATION
Nonradioactive dangerous waste landfill closure/postclosure plan, 15:48263 (R;US)

SITE REHABILITATION
See REMEDIAL ACTION

SITE SELECTION
Electrical generating station proposal: Complete verbatim transcript, 15:48515 (R;CA)

SITES (REACTOR)
See REACTOR SITES

SKIN
Dermal penetration and systemic distribution of ^{14}C-labeled vitamin E human skin grafted athymic nude mice, 15:49656 (R;US)
Investigation of the permeation of radiocontrast agent into the experimentally irritated stratum corneum, 15:49692 (R;DE;In German)

SLC
See STANFORD LINEAR COLLIDER

SLC DETECTORS
Design of a wire imaging synchrotron radiation detector, 15:49322 (J;US)

SLIGHTLY ENRICHED URANIUM
Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988, 15:48242 (R;XA)

SLUGS (FUEL)
See FUEL RODS

SMALL-SCALE HYDROELECTRIC POWER PLANTS
Operation of an isolated mini-hydro plant in northern Quebec, 15:48448 (RA;CA)
Small hydro-electric power stations, 15:48446 (R;FR;In FR, EN)

SMES
See SUPERCONDUCTING MAGNETIC ENERGY STORAGE

SNR REACTOR
Reactor transients tests for SNR fuel elements in HFR reactor, 15:48635 (RA;FR;In German)

SNR-1 REACTOR
See SNR REACTOR

SNR-300 REACTOR
See SNR REACTOR

SOCIAL SERVICES
Artificial intelligence for subject interviewing, 15:48699 (R;US)

SOCIO-ECONOMIC ASPECTS
See SOCIO-ECONOMIC FACTORS

SOCIO-ECONOMIC FACTORS
Ecological characterization atlas of coastal Alabama: Map narrative, 15:49571 (R;US)

SODIUM
Improved Fischer-Tropsch Synthesis catalysts for indirect coal liquefaction: Quarterly technical progress report No. 8, 1 July–30 September 1987, 15:48075 (R;US)
Polarization effects in reactive scattering of Na atoms in the 4D level, 15:49885 (RA;US)
SWAAM-code development and verification and application to steam generator designs, 15:48581 (R;US)
The reactions of ground- and excited-state sodium atoms with hydrogen halide molecules, 15:49138 (RA;US)
Thermophysical and thermochemical properties of fast reactor materials, 15:48872 (R;FR)

SODIUM CHLORIDES
Mechanisms of surface enrichment and adhesion of coal combustion particulates: Eighth and ninth quarterly reports, June 16, 1988–December 15, 1988, 15:48113 (R;US)
Near-critical $NaCl-H_2O$: An equation of state and discussion of anomalous properties, 15:49041 (RA;US)

SODIUM IODIDE DETECTORS
See NAI DETECTORS

SODIUM-SULFUR BATTERIES
Chemical stability of sodium beta″-alumina electrolyte in sulfur/sodium polysulfide melts, 15:49111 (RA;US)
Sodium/beta″-alumina/organosulfur batteries operating at intermediate temperatures, 15:49112 (RA;US)
Transference number calculations for sodium polysulfides, 15:49119 (RA;US)

SOFC
See SOLID ELECTROLYTE FUEL CELLS

SOIL MECHANICS
Materials: From theory to practice: Proceedings, 15:49744 (R;CA)

SOILING
See SURFACE CONTAMINATION

SOILS
Acidification
Current status of forest decline and its research activities in Europe, 15:48702 (R;JP;In Japanese)

Combustion
Reuse of incinerated soil residues in land reclamation, 15:49567 (R;US)

Contamination
Background document for Third Third wastes to support 40 CFR part 268 land-disposal restrictions. Final rule. Third Third waste volumes, characteristics, and required and available treatment capacity. Volume 1. Executive summary. Chapter 1 and Chapter 2, 15:49578 (R;US)
Delegation of remedy selection to regions. Directive (Final), 15:49580 (R;US)
Final response to BDAT related comments document. K071 and K106: Mercury cell process wastes K086: Residues from ink production wastes containing cyanide. Volume 1-L, 15:49608 (R;US)
Final response to BDAT related comments document: General BDAT issues. Volume 1-A-3, 15:49517 (R;US)

Health assessment for Abex Corporation, Portsmouth, Elizabeth County, Virginia, Region 3. CERCLIS No. VAD980551683. Preliminary report, 15:49582 (R;US)
Health assessment for Elizabethtown Landfill, Elizabethtown, Lancaster County, Pennsylvania, Region 3. CERCLIS No. PAD980539712. Final report, 15:49614 (R;US)
Health assessment for Ewan Property, Shamong Township, Burlington County, New Jersey, Region 2. CERCLIS No. NJD980761365. Final report, 15:49626 (R;US)
Health assessment for Fletcher's Paint Works and Storage Facility Hazardous Waste Material, Milford, Hillsborough County, New Hampshire, Region 1. CERCLIS No. NHD981067614. Preliminary report, 15:49615 (R;US)
Health assessment for GBF, Inc., Dump, Antioch, Contra Costa County, California, Region 9. CERCLIS No. CAD980498562. Preliminary report, 15:49620 (R;US)
Health assessment for Gautier Oil Co., Inc., Gautier, Mississippi, Region 4. CERCLIS No.MSD098596489. Preliminary report, 15:49534 (R;US)
Health assessment for Imperial Oil Co., Inc./Champion Chemicals, Marlboro Township, Monmouth County, New Jersey, Region 2. CERCLIS No. NJD980654099. Final report, 15:49624 (R;US)
Health assessment for Intersil, Inc./Siemens Components, Cupertino, Santa Clara County, California, Region 9. CERCLIS No. CAD041472341. Preliminary report, 15:49627 (R;US)
Health assessment for Kent County Landfill (Houston), Houston, Kent County, Delaware, Region 3. CERCLIS No. DED980705727. Preliminary report, 15:49535 (R;US)
Health assessment for Landfill and Development Company, Mount Holly, New Jersey, Region 2. CERCLIS No. NJD048044325. Final report, 15:49611 (R;US)
Health assessment for Radiation Technology, Inc., Rockaway, Morris County, New Jersey, Region 2. CERCLIS No. NJD047684451. Final report, 15:49625 (R;US)
Health assessment for South Municipal Water Supply Well, Hillsborough County, Peterborough, Cheshire County, New Hampshire, Region 1. CERCLIS No. NHD980671069. Final report, 15:49616 (R;US)
Health assessment for Tex Tin Corporation, National Priorities List Site, Texas City, Texas, Region 6. CERCLIS No. TXD062113329. Preliminary report, 15:49617 (R;US)
Health assessment for Tri-City Industrial Disposal Site, Brooks, Kentucky, Region 4. CERCLIS No. KYD981028350. Preliminary report, 15:49619 (R;US)
Health assessment for Union Carbide Disposal/Red Oak Landfill Site, Red Oak, Iowa, Region 7. CERCLIS No. IAD980643509. Preliminary report, 15:49539 (R;US)
Redelegation of authority under CERCLA and SARA. Directive (Final), 15:49581 (R;US)
Superfund Record of Decision (EPA Region 2): Roebling Steel, NJ. (First remedial action), March 1990, 15:49631 (R;US)
Superfund Record of Decision (EPA Region 3): C and R Battery, VA. (First remedial action), March 1990. Final report, 15:49629 (R;US)
Superfund Record of Decision (EPA Region 3): Westline, PA. (First remedial action) (amendment), March 1990, 15:49630 (R;US)

Decontamination
In-situ biorestoration of a subsoil contaminated with gasoline. Interim report, 15:48156 (R;NL)

Erosion
Soil erosion rates from mixed soil and gravel surfaces in a wind tunnel, 15:49584 (R;US)

Excavation
Air/Superfund national technical guidance study series. Development of example procedures for evaluating the air impacts of soil excavation associated with Superfund remedial actions. Final report, 15:49544 (R;US)

Field Tests
Field evaluation of grillage foundation uplift capacity: Final report, 15:48674 (R;US)

Hydraulic Conductivity
Diffusion coefficients and hydraulic conductivity in unsaturated Hanford soils and sediments, 15:48336 (BA;US)
Predicted drainage at a semiarid site: Sensitivity to hydraulic property description and vapor flow, 15:48287 (R;US)

Information
Ecological characterization atlas of coastal Alabama: Map narrative, 15:49571 (R;US)

Radionuclide Migration
Evaluation of water flow velocity, dispersion length and retardation factor in radionuclide migration test using undisturbed samples of aerated sandy soil layer, 15:49572 (R;JP;In Japanese)
Geochemical modelling of the Broubster natural analogue site Caithness, Scotland, 15:48275 (R;FR)
One-dimensional radionuclide transport under time-varying conditions, 15:48305 (BA;US)
Simulation on reactive chemical transport in varying thermal field with reaction-flow coupling, 15:48306 (BA;US)

Sampling
Performance evaluation of a groundwater and soil gas remedial action, 15:49566 (R;US)
Results of the radiological survey at the Granite City Steel faciltiy, Granite City, Illinois, 15:49575 (R;US)

X-Ray Spectroscopy
Synchrotron x-ray sources and new opportunities in the soil and environmental sciences: Workshop report, 15:49565 (R;US)

SOLAR CELL RECEIVERS
See SOLAR RECEIVERS

SOLAR COLLECTORS
Development of the Fresnel-lens-type solar collector, 15:48474 (R;JP)

SOLAR COOLING SYSTEMS
Colorado State University program for developing, testing, evaluating and optimizing solar heating and cooling systems: Project status report for the months of July and August 1990, 15:48472 (R;US)

SOLAR CORONA
Numerical study of compressible magnetoconvection with an open transitional boundary, 15:49748 (R;US)

SOLAR HEATING SYSTEMS
See also PASSIVE SOLAR HEATING SYSTEMS
Colorado State University program for developing, testing, evaluating and optimizing solar heating and cooling systems: Project status report for the months of July and August 1990, 15:48472 (R;US)

SOLAR NEUTRINOS
Status of solar neutrino observations and prospects for future experiments, 15:49845 (BA;US)
Strength function of xenon 127 and cross section of $^{127}I(\nu_e, e^-)^{127}Xe$ reaction, 15:50028 (R;SU;In Russian)

SOLAR RECEIVERS
Bench-scale testing of a heat-pipe receiver for solar thermal electric applications, 15:48470 (R;US)

SOLAR SEA POWER PLANTS
See OCEAN THERMAL POWER PLANTS

SOLAR SYSTEM
Infrared spectroscopy in astronomy: Proceedings of the 22 Eslab Symposium, 15:49750 (R;FR)

SOLAR THERMAL RECEIVERS
See SOLAR RECEIVERS

SOLAR WATER HEATERS
Colorado State University program for developing, testing, evaluating and optimizing solar heating and cooling systems: Project status report for the months of July and August 1990, 15:48472 (R;US)

SOLAR WIND
Development of a comprehensive magnetohydrodynamic model of solar-terrestrial interaction. Final report, 1 March 1986-30 September 1988, 15:49854 (R;US)

SOLDERED JOINTS
Solderability of environmentally exposed Sn-plated surfaces, 15:48897 (R;US)
Thermal stresses in layered electrical assemblies bonded with solder, 15:49218 (R;US)

SOLENOIDS
Characterization of field errors of layer wound short solenoids, 15:49266 (R;US)
SOLID CLUSTERS
Chemical identification of icosahedral structure for cobalt and nickel clusters, 15:48865 (R;US)
SOLID ELECTROLYTE FUEL CELLS
Lightweight solid-polymer electrolyte fuel cell with stack power density of 3 kW/lb (7kW/kg), 15:48759 (R;US)
SOLID ELECTROLYTES
Electrochemical properties of solid electrolytes, 15:49110 (RA;US)
Work in progress, 15:49114 (RA;US)
SOLID SCINTILLATION DETECTORS
See also BGO DETECTORS
NAI DETECTORS
A more rugged ZnS(Ag) alpha scintillation detector, 15:49564 (J;US)
High speed imaging with a tapped solid state sensor, 15:49333 (J;US)
Readout techniques and radiation damage of undoped cesium iodide, 15:48940 (J;US)
SOLID SOLUTIONS
Fundamental studies of bond breaking and forming on ultrafast timescales, 15:49036 (RA;US)
SOLID STATE PHYSICS
Photoelectron spectroscopy, 15:49130 (RA;US)
Proceedings of the seminar of young scientists HEPI AN Kaz SSR. Part 2: 2. Solid state physics and mass transfer simulation, 15:50080 (R;SU;In Russian)
SOLID WASTES
Assessment of municipal solid waste for energy production in the western United States, 15:48833 (R;US)
Hazardous waste characterization of solid wastes generated from clean coal technologies, 15:48091 (R;US)
The stabilization and utilization of coal solid wastes, 15:48095 (R;US)
SOLIDS FLOW
Determination of flow-regime boundaries for cohesive particles: Quarterly report, December 20, 1989–March 20, 1990, 15:48211 (R;US)
Determination of flow-regime boundaries for cohesive particles: Quarterly report, September 20–December 19, 1989, 15:48210 (R;US)
SOLUTIONS
See also AQUEOUS SOLUTIONS
LEACHATES
PROCESS SOLUTIONS
SOLID SOLUTIONS
Ion chromatography in the manufacture of multilayer circuit boards, 15:49209 (R;US)
SOLVENT PROPERTIES
Dynamical solvent effects on electron-transfer processes: Recent progress and perspectives. Technical report, 15:49030 (R;US)
SOLVENTS
See also ORGANIC SOLVENTS
Best demonstrated and available technology (BDAT) background document for wastes from the production of epichlorohydrin K017. Final report, 15:49606 (R;US)
Final response to BDAT related comments document. Mixed radioactive hazardous wastes, polynuclear aromatic u wastes, halogenated aliphatic U wastes, non-halogenated aromatic U wastes, F002-f006, F019. Volume 1-J, 15:49525 (R;US)
SOMMERFELD-WATSON THEORY
Elementary inversion, energy velocity, and a generalized Sommerfeld theorem, 15:50097 (R;US)
SORGHUM
Research on sweet sorghum (Sorghum Bicolor), 15:48431 (RA;LU)
SOURCE TERMS
An appreciation of the events, models and data used for LMFBR radiological source term estimations, 15:48650 (R;FR)
SOUTH AFRICA
Review and evaluation of main roadway intersection techniques for use in the Sydney coal field, 15:48102 (R;CA)
SOUTHEAST REGION
See FEDERAL REGION IV
SOUTHWEST REGION
See FEDERAL REGION VI
SOVIET UNION
See USSR
SPACE FLIGHT
Remote sensing of the thermosphere, plasmasphere, and exosphere, 15:49361 (J;US)
The shuttle activation monitor: A system for direct comparison of gamma-ray detector materials in a space environment, 15:49362 (J;US)
SPACE HEATING
Development of an operating aid device for ground water heat pump system, 15:48768 (R;FR;In French)
Experimental study of aeraulics heating. Final Report, 15:48767 (R;FR;In French)
Field investigation of domestic hot water tanks as space heating appliances: Final report, 15:48782 (R;CA)
SPACE HVAC SYSTEMS
An analysis of containment venting as a severe accident mitigation strategy for the BWR Mark II containment, 15:48670 (J;US)
SPACE LATTICES
See CRYSTAL LATTICES
SPACE VEHICLE COMPONENTS
Potential for advanced thermoplastic composites in space systems, 15:49405 (R;US)
SPACE VEHICLES
Diode laser satellite systems for beamed power transmission, 15:48467 (R;US)
Galileo light-weight radioisotope heater units design and safety analysis, 15:48408 (R;US)
SPACECRAFT POWER SUPPLIES
Reference concepts for a space-based hydrogen-oxygen combustion, turboalternator, burst power system, 15:49406 (R;US)
SPAIN
Project LEBEN - Galicia (Spain): Energy exploitation of biomass, 15:48416 (RA;LU)
SPECIAL POWER EXCURSION REACTOR-2
See SPERT-2 REACTOR
SPECIFIC GRAVITY
See DENSITY
SPECIFIC VOLUME
See DENSITY
SPECIFIC WEIGHT
See DENSITY
SPECIFICATIONS
Hanford Site radioactive solid waste acceptance criteria, 15:48292 (R;US)
SPECIMEN HOLDERS
See SAMPLE HOLDERS
SPECTRA (NEUTRON)
See NEUTRON SPECTRA
SPECTROMETERS
See also BETA SPECTROMETERS
GAMMA SPECTROMETERS
HEAVY ION SPECTROMETERS
MASS SPECTROMETERS
TIME-OF-FLIGHT SPECTROMETERS
ULTRAVIOLET SPECTROMETERS
X-RAY SPECTROMETERS
Large coaxial germanium detectors, 15:49339 (J;US)
SPECTROPHOTOMETERS
Remote sensing of the thermosphere, plasmasphere, and exosphere, 15:49361 (J;US)
SPENT FUEL CASKS
^{14}C release failed spent fuel containers, 15:48379 (BA;US)
A program to qualify ductile cast iron for use as a containment material for Type B transport cask, 15:49165 (R;US)
Assessment of the iron-based, stressed-shell container, 15:48286 (R;CA)

BR-100 spent fuel shipping cask development, 15:49172 (BA;US)
Benchmarking of dose rate calculations for spent fuel transportation casks, 15:49160 (R;US)
Certification challenges in the development of an innovative high payload capacity spent fuel transportation cask, 15:49170 (BA;US)
End effects in the criticality analysis of burnup credit casks, 15:48230 (R;US)
Experience with certifying borated stainless steel as a shipping cask basket material, 15:48383 (BA;US)
Investigation of burnup credit allowance in the criticality safety evaluation of spent fuel casks, 15:48382 (BA;US)
Materials selection issues for structural components of transportation casks, 15:48240 (BA;US)
Method for determining the fuel contribution to the source term in transport casks, 15:48387 (BA;US)
Operational considerations in specifying legal weight vehicles for the highway transport of spent nuclear fuel, 15:48381 (BA;US)
Optimizing spent fuel cask designs for use in the federal waste management system, 15:49174 (BA;US)
Robotic inspection of prototype titanium diffusion-bond final-closure weld: Final report, 15:48235 (R;CA)
Scale-model simulation of impact of a rail-locomotive coupler on the irradiated-fuel transportation cask, 15:48234 (R;CA)
Size and transportation capabilities of the existing U.S. cask fleet, 15:48241 (BA;US)

SPENT FUEL STORAGE
See also MONITORED RETRIEVABLE STORAGE
NUHOMS modular spent-fuel storage system: Design, licensing and construction, 15:48233 (R;US)
Spent fuel storage requirements for nuclear utilities and OCRWM, 15:48345 (BA;US)
Views on the calculation of flow and dispersion processes in fractured rock, 15:48290 (R;SE)

SPENT FUELS
Burnup
Burnup credit feasibility for BWR spent fuel shipments, 15:48526 (R;US)
End effects in the criticality analysis of burnup credit casks, 15:48230 (R;US)
Reactor critical benchmark calculations for burnup credit applications, 15:48231 (R;US)
Criticality
Reactor critical benchmark calculations for burnup credit applications, 15:48231 (R;US)
Validation of scale-4 for LWR [Light Water Reactor] fuel in transportation and storage cask conditions, 15:48229 (R;US)
Dissolution
Consolidated fuel reprocessing program simulation of a continuous rotary dissolver, 15:48226 (BA;US)
Emission
Deposition of airborne particles from fractured spent fuel or high-level waste, 15:48374 (BA;US)
Monitored Retrievable Storage
Preliminary conceptual design description of the proposed DOE store-only monitored retrievable storage (MRS) facility, 15:48357 (BA;US)
Particle Size
Development of a crud particle size distribution and its effect on cask source term and containment analyses, 15:48221 (BA;US)
Radioactive Waste Disposal
Assessment of the iron-based, stressed-shell container, 15:48286 (R;CA)
Radioactive Waste Management
The expected condition of spent LWR fuel on delivery to a repository, 15:48370 (BA;US)
Reactivity
Burnup credit feasibility for BWR spent fuel shipments, 15:48526 (R;US)
Remote Handling
Development of remote disassembly technology for liquid-metal reactor (LMR) fuel, 15:48579 (R;US)
Specifications
Acceptance of spent fuel of varying characteristics, 15:48227 (BA;US)
Spent Fuel Casks
Validation of scale-4 for LWR [Light Water Reactor] fuel in transportation and storage cask conditions, 15:48229 (R;US)
Spent Fuel Storage
Validation of scale-4 for LWR [Light Water Reactor] fuel in transportation and storage cask conditions, 15:48229 (R;US)
Transport
Identification of facility constraints that impact transportation operations, 15:48239 (BA;US)
Underground Disposal
Evaluation of near-field thermal environment conditions for a spent fuel repository in tuff, 15:48320 (BA;US)
International safeguards relevant to geologic disposal of high-level wastes and spent fuels, 15:48302 (BA;US)
Waste Transportation
Transporting spent nuclear fuel: A framework for decision-making, 15:48232 (R;US)

SPENT SHALES
Distribution of a crystalline nickel (II) porphyrin in the Green River Formation, 15:48206 (R;US)
Formation of calcium and magnesium molybdate complexes in dilute aqueous solutions and evaluation of powellite solubility in spent oil shale, 15:48202 (R;US)

SPERT-2 REACTOR
SPERT-II benchmarks of a dynamic model for the advanced neutron source reactor, 15:48671 (J;US)

SPHERES
Evolution of surface area during the controlled growth of silica spheres, 15:48973 (R;US)

SPIN-OFF
See TECHNOLOGY TRANSFER

SPRAY DRYING
Dry FGD [flue-gas desulfurization] at Argonne National Laboratory, 15:48500 (R;US)

SPRAY PONDS
See COOLING PONDS

SQUARE-WAVE GENERATORS
See FUNCTION GENERATORS

SQUID DEVICES
Computer-oriented, multichannel, direct-current, superconducting quantum interference device. Final report, 30 September 1988-31 March 1989, 15:49201 (R;US)
SQUIDs: Principles, noise and application, 15:49221 (BA;US)

SRM
See CALIBRATION STANDARDS

ST LAWRENCE RIVER
Bottom ice, in situ and long term evaluation, 15:48447 (RA;CA)

STAINLESS STEEL-18-4-1
See STAINLESS STEELS

STAINLESS STEEL-19-9DL
See STAINLESS STEELS

STAINLESS STEEL-310
Corrosion behavior of materials in FBC [fluidized-bed combustion] environments, 15:48105 (R;US)

STAINLESS STEEL-316
Compatibility of 316L stainless steel with the liquid alloy Pb17Li, 15:48859 (R;FR)

STAINLESS STEEL-Z2CND17-12
See STEEL-CR17NI12MO3-L

STAINLESS STEEL-Z3CND17-12
See STEEL-CR17NI12MO3-L

STAINLESS STEELS
See also CHROMIUM STEELS
Analytical electron microscopy studies of radiation damage, 15:48899 (J;US)
Experience with certifying borated stainless steel as a shipping cask basket material, 15:48383 (BA;US)
Research programs for LWR pressure boundary components in Japan, 15:48535 (RA;XA)

STANDARD MODEL
Does there exist a gravitational analogue of the electro-weak unification, 15:49919 (R;BR)
STANDARD REFERENCE MATERIALS
See CALIBRATION STANDARDS
STANDING CROP
See BIOMASS
STANFORD LINEAR ACCELERATOR CENTER
Construction and testing of the SLD Cerenkov ring imaging detector, 15:49359 (J;US)
Design of a wire imaging synchrotron radiation detector, 15:49322 (J;US)
Initial performance of the wire imaging synchrotron radiation detector, 15:49268 (J;US)
The electronics and data acquisition system for the wire imaging synchrotron radiation detector at the SLC, 15:49272 (J;US)
STANFORD LINEAR COLLIDER
DEPOT: Database for electronics parts and other things, 15:49271 (J;US)
The electronics and data acquisition system for the wire imaging synchrotron radiation detector at the SLC, 15:49272 (J;US)
STAR EVOLUTION
Infrared spectroscopy in astronomy: Proceedings of the 22 Eslab Symposium, 15:49750 (R;FR)
Interstellar gas cycling powered by star formation, 15:49747 (R;FR)
The great supernova of 1987, 15:49840 (BA;US)
STARS
See also BINARY STARS
GIANT STARS
NEUTRON STARS
SYMBIOTIC STARS
Herbig Ae/Be stars: fine structure far-infrared lines, 15:49781 (RA;FR)
JCMT observations of the circumstellar envelope IRC + 10216, 15:49792 (RA;FR)
Thermal relaxation oscillations in horizontal-branch stars, 15:49848 (J;US)
STATE BUILDINGS
See PUBLIC BUILDINGS
STATES (ENERGY)
See ENERGY LEVELS
STATISTICAL DATA
Modeling histogram data with piecewise polynomials, 15:50237 (R;US)
STEAM CONDENSERS
Control of microbiofouling using bacteriophage. 2.: Detection of phages and fundamental study of their lytie effect on fouling bacteria, 15:48487 (R;JP;In Japanese)
STEAM GENERATION
A coal fired steam generator demonstration for heavy oil recovery operations, 15:48194 (RA;CA)
STEAM GENERATORS
Main current development programs in Belgium, 15:48607 (RA;XA)
STEAM INJECTION
A semianalytical thermal model for linear steamdrive, 15:48135 (BA;US)
Steam circulation in horizontal wellbores, 15:48196 (RA;CA)
STEAM LINES
Metallurgical investigation of main-steam-line weldment cracking, Lakeview TGS, 15:48493 (R;CA)
STEAM TURBINES
Thermodynamics of steam-turbine cycle with minimum coolant flow rate, 15:48603 (R;SU;In Russian)
STEEL-000KH25
See STAINLESS STEELS
STEEL-000KH26
See STAINLESS STEELS
STEEL-00KH20N32T
See STAINLESS STEELS
STEEL-03KH13AG13
See STAINLESS STEELS
STEEL-0KH18G8N2T
See STAINLESS STEELS
STEEL-12KH2MV8FB
See STEELS
STEEL-12KH2V5FB
See STEELS
STEEL-18MNV6
See STEELS
STEEL-1KH12V2MF
See CHROMIUM STEELS
STEEL-42KH2GSNM
See CHROMIUM-NICKEL-MOLYBDENUM STEELS
STEEL-9KHS
See CHROMIUM STEELS
STEEL-ASTM-A533-B
Crack-arrest behavior in SEN wide plates of low-upper-shelf base metal tested under nonisothermal conditions: WP-2 series, 15:48608 (R;US)
STEEL-CR12MOV
Extrapolation of stress rupture data on 9 to 12% Cr steels, 15:48871 (R;FR)
STEEL-CR17NI12MO3-L
The function of the HFR, Petten, in the development of plasma facing components for fusion reactors, 15:50172 (RA;FR)
STEEL-CR9MONBV
Extrapolation of stress rupture data on 9 to 12% Cr steels, 15:48871 (R;FR)
STEEL-EHP699
See CHROMIUM-NICKEL-MOLYBDENUM STEELS
STEEL-KH12M
See STEEL-CR12MOV
STEEL-KH13S2YU2BT
See CHROMIUM STEELS
STEEL-KH14K9N6M5
See CHROMIUM-NICKEL-MOLYBDENUM STEELS
STEEL-KH15N20M2T2
See CHROMIUM-NICKEL-MOLYBDENUM STEELS
STEEL-KH17N5M3
See CHROMIUM-NICKEL-MOLYBDENUM STEELS
STEEL-R18
See CHROMIUM STEELS
STEELS
See also AUSTENITIC STEELS
FERRITIC STEELS
Development of the Structural Materials Information Center, 15:48646 (R;US)
Effects of cathodic protection potential and stress ratio on fatigue thresholds of structured steels in sea water, 15:48894 (R;GB)
Extrapolation of stress rupture data on 9 to 12% Cr steels, 15:48871 (R;FR)
Proceedings of the third International Atomic Energy Agency specialist's meeting on subcritical crack growth: Opening session and Technical session 1, 15:48537 (R;US)
Proceedings of the third International Atomic Energy Agency specialists' meeting on subcritical crack growth: Technical sessions 2, 3, and 4 and Recommendations and conclusions Session 5, 15:48538 (R;US)
STELLAR ATMOSPHERES
Stellar astrophysics, 15:49827 (RA;ZA)
STELLAR WINDS
Predictions of infrared recombination lines in stellar winds of hot stars, 15:49790 (RA;FR)
The steady state solutions of radiatively driven stellar winds for a non-Sobolev, pure absorption model, 15:49847 (J;US)
STELLARATORS
See also TORSATRON STELLARATOR
Adiabatic invariant and evaluation of particle loss in helical torus, 15:50180 (R;JP)
Loss cone region in toroidal helical systems, 15:50181 (R;JP)
STIRLING ENGINES
Bench-scale testing of a heat-pipe receiver for solar thermal electric applications, 15:48470 (R;US)
Preliminary designs for 25 kWe advanced Stirling conversion systems for dish electric applications, 15:48469 (R;US)

Study on feasible applications of stirling cycle machine, 15:48837 (R;JP;In Japanese)

STOPPING POWER
The non-observation of cold nuclear fusion in electrolytic cells stimulated by high intensity stopped muons and pions, 15:50198 (RA;GB)

STOPPING POWER (TOTAL ATOMIC)
See STOPPING POWER

STOPPING POWER (TOTAL LINEAR)
See STOPPING POWER

STOPPING POWER (TOTAL MASS)
See STOPPING POWER

STORAGE (SPENT FUEL)
See SPENT FUEL STORAGE

STORAGE BATTERIES
See ELECTRIC BATTERIES

STORAGE BATTERIES (LEAD-ACID)
See LEAD-ACID BATTERIES

STORAGE FACILITIES
NUHOMS modular spent-fuel storage system: Design, licensing and construction, 15:48233 (R;US)

STORAGE RINGS
See also BROOKHAVEN RHIC
LEP STORAGE RINGS
SUPERCONDUCTING SUPER COLLIDER
On POLEX experiment at UNK, 15:49278 (R;SU;In Russian)

STORES
See COMMERCIAL BUILDINGS

STOVER
See AGRICULTURAL WASTES

STRANGE BARYONS
See HYPERONS

STRANGE MESONS
Strange meson mass spectrum in relativistic model for quasi-independent quarks, 15:49934 (R;SU)

STRATEGIC DEFENSE INITIATIVE
See BALLISTIC MISSILE DEFENSE

STREAMER SPARK CHAMBERS
Experience in construction and testing of plastic limited streamer chambers, 15:49331 (J;US)

STRENGTH (FRACTURE)
See FRACTURE PROPERTIES

STRENGTH (TENSILE)
See TENSILE PROPERTIES

STRENGTH FUNCTIONS
$YBa_2Cu_3O_x$ composites with improved toughness and strength, 15:48916 (R;US)

STRESS CORROSION
BWR [Boiling Water Reactor] Owners Group Intergranular Stress Corrosion Cracking Research Program: Executive summary: Phase 2 (1984–1988): Final report, 15:48528 (R;US)

STRING MODELS
Scattering amplitude of string on orbifold, 15:49973 (RA;JP;In Japanese)
'String amplitudes': What can we do about the divergent integrals?, 15:49975 (RA;JP)

STRIPPER FOILS
See BEAM STRIPPERS

STRIPPERS
See BEAM STRIPPERS

STRONTIUM
Retention of alkaline earth elements in man: Final report for the period 1 April 1986 - 14 May 1989, 15:49712 (R;XA)

STRONTIUM 90
Radioactivity survey data in Japan, part 1: Environmental materials, 15:49603 (R;JP)
Radioactivity survey data in Japan, part 2: Dietary materials, 15:49705 (R;JP)

STRONTIUM OXIDES
Development of high-Tc superconducting wire with high critical current density, 15:48935 (R;JP)
Excess oxygen defects in layered cuprates, 15:48913 (R;US)
Microfilamentary $Bi_2Sr_2Ca_1Cu_2O_8$ fibers, 15:48922 (R;US)
Preparation and structural characterization of Tl-Sr-Ca-Cu-O superconducting materials, 15:48934 (R;JP)

STRONTIUM SULFIDES
A study of the thermoelectric properties of Ca, Sr and Hg substituted lanthanum sulfides, 15:48956 (R;US)

STRUCTURAL MATERIALS
See BUILDING MATERIALS

STRUCTURES (BUILDINGS)
See BUILDINGS

SUBCOOLED BOILING
Present status of research on boiling critical heat flux in narrow channel, 15:49184 (RA;JP;In Japanese)

SUBSURFACE ENVIRONMENTS
Performance evaluation of a groundwater and soil gas remedial action, 15:49566 (R;US)

SUBURBS
See URBAN AREAS

SULFATES
See also CALCIUM SULFATES
CESIUM SULFATES
Modeled sulfur deposition trends since 1990 in North America, 15:49456 (R;US)
Summary of the NAPAP state of science report on deposition monitoring in North America, 1979–1987, 15:49457 (R;US)
Technical committee for the long-range transport of atmospheric pollutants in western and northern Canada: Annual report, 1987, 15:49467 (R;CA)

SULFHYDRYL COMPOUNDS
See THIOLS

SULFIDATION
Reaction kinetics of the $CaO-SO_2$ system in absence of intergrain pore diffusion: Annual report, 15:48108 (R;US)

SULFIDES
See also CADMIUM SULFIDES
CALCIUM SULFIDES
GERMANIUM SULFIDES
HYDROGEN SULFIDES
IRON SULFIDES
LANTHANUM SULFIDES
MERCURY SULFIDES
SELENIUM SULFIDES
STRONTIUM SULFIDES
ZINC SULFIDES
Final response to BDATt related comments document D003. Volume 1-D, 15:49519 (R;US)

SULFITES
Work in progress, 15:49461 (RA;US)

SULFONIC ACIDS
Oxidation of chromium(II) by hydroxylamine-O-sulfonic acid, 15:49034 (R;US)

SULFUR
A technical and economic evaluation of sulphur basepad recovery and reclamation, 15:49585 (RA;CA)
Bioprocessing of coal. 1.: Microorganisms for coal processing, 15:48074 (R;JP;In Japanese)
Characterization of leachate produced from sulphur-contaminated soils, 15:48183 (RA;CA)

SULFUR DIOXIDE
Adsorption and surface reactions of H_2S and SO_2 on Cu(100) studied by electron-energy-loss spectroscopy, 15:49134 (RA;US)
Formation of oxyacids of sulfur from SO_2, 15:49051 (RA;US)
Limb demonstration project extension: Quarterly report No. 12, February, March, and April, 1990, 15:48502 (R;US)
Modeled sulfur deposition trends since 1990 in North America, 15:49456 (R;US)
Reaction kinetics of the $CaO-SO_2$ system in absence of intergrain pore diffusion: Annual report, 15:48108 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 6, October 1, 1988–December 31, 1988, 15:48508 (R;US)

Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 5, July 1, 1988–September 30, 1988, 15:48507 (R;US)
Simultaneous particulates, NOx_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 9, July 1, 1989–September 30, 1989, 15:48511 (R;US)
Summary of the NAPAP state of science report on deposition monitoring in North America, 1979–1987, 15:49457 (R;US)
The TRW entrained combustor retrofit at Orange and Rockland Utilities, Lovett Station Unit 3, 15:48486 (R;US)

SULFUR HYDRIDES
See HYDROGEN SULFIDES

SULFUR OXIDES
See also SULFUR DIOXIDE
Deposition, corrosion, erosion and sulfur emission studies related to coal combustion: Annual report, 15:48109 (R;US)
Members committee report: Critical point one, 15:49465 (R;CA)

SULFUR SULFIDES
See SULFUR

SULFUR-OXIDIZING BACTERIA
Bioprocessing of coal. 1.: Microorganisms for coal processing, 15:48074 (R;JP;In Japanese)

SULFURIC ACID
Acid air pollutant mixtures: Respiratory system responses and effects of exercise, 15:49720 (R;US)
Inhalation toxicology of combined acid and soot particles. Final report, 15:49719 (R;US)

SUN
Status of solar neutrino observations and prospects for future experiments, 15:49845 (BA;US)
The intermediate-degree g-mode spectrum of the sun: Its properties and their implications to the solar neutrino paradox, 15:49844 (BA;US)

SUPER HIGH FREQUENCY RADIATION
See RADIOWAVE RADIATION

SUPERCOMPUTERS
Dynamic processor self-scheduling for general parallel nested loops, 15:50247 (J;US)
Supercomputer work-station communication. Special report, 15:50209 (R;US)

SUPERCONDUCTING COILS
Mechanical support of superconducting coils, 15:49250 (R;US)

SUPERCONDUCTING COMPOSITES
Nonlinear pressure dependence of T_c in single-crystal superconducting BiCaSrCuO, 15:48927 (RA;US)
Normal and superconducting properties of new high-T_c materials, 15:48965 (RA;US)
Synthesis and structure of phosphine, sulfide and amine adducts of the MO_6S_8 and W_6S_8 cluster units, molecular derivatives of Chevrel phase clusters and their tungsten analogues, 15:48937 (BA;US)

SUPERCONDUCTING FILMS
Computer-controlled ion beam deposition systems for high T_c superconductor and other multi-component oxide thin films and layered structures, 15:48911 (R;US)
Laser applications for high-T_c superconductors, 15:49206 (R;US)

SUPERCONDUCTING GENERATORS
Key technologies of superconducting generator, 15:49214 (R;JP)

SUPERCONDUCTING JUNCTIONS
Proximity effect, 15:49210 (RA;US)

SUPERCONDUCTING MAGNETIC ENERGY STORAGE
Electric utility benefits of superconducting magnetic energy storage, 15:48497 (R;US)

SUPERCONDUCTING MAGNETS
Mathematical model and program for superconducting magnet mechanics study, 15:49256 (R;SU;In Russian)
Open-gradient magnetic separation for physical coal cleaning: Results for Pittsburgh No. 8 and Upper Freeport coals, 15:48071 (R;US)

SUPERCONDUCTING QUANTUM INTERFERENCE DEVICES
See SQUID DEVICES

SUPERCONDUCTING SUPER COLLIDER
A proposed scalable parallel open architecture data acquisition system for low to high rate experiments, test beams and all SSC detectors, 15:49274 (J;US)
Effects of radiation damage to ionization chamber liquids, 15:49372 (J;US)
Measurement of proton induced radiation damage to CMOS transistors and PIN diodes, 15:49374 (J;US)
Optical data transmission at the superconducting super collider, 15:49368 (J;US)
Report of the Department of Energy (DOE) Office of Energy Research Review Committee on the site-specific conceptual design of the Superconducting Super Collider, 15:49227 (R;US)
Studies in the radiation resistance of plastic scintillators: Review and prospects, 15:49373 (J;US)

SUPERCONDUCTING WIRES
Development of high-Tc superconducting wire with high critical current density, 15:48935 (R;JP)
Fabrication of composite high temperature superconductor wires from $Ag/YBa_2Cu_3O_x$ power produced by $AgNO_3$ decomposition, 15:48901 (R;US)
Production techniques for discontinuous filament A-15 superconductor wire, 15:48876 (R;US)

SUPERCONDUCTIVITY
Search for nonphonon mechanisms of superconductivity, 15:48889 (RA;US)

SUPERCONDUCTORS
Application of in-beam perturbed angular distribution to the study of high-T_c oxides, 15:50072 (R;JP)
Fluctuations and high-T_c superconductivity, 15:48930 (RA;US)
Major parameters of the high-T_c oxides, 15:49122 (RA;US)
Origin of high T_c, 15:49121 (RA;US)
Proximity effect, 15:49210 (RA;US)
$YBa_2Cu_3O_x$ composites with improved toughness and strength, 15:48916 (R;US)

SUPERCRITICAL FLOW
See TURBULENT FLOW

SUPERFUND
Delegation of remedy selection to regions. Directive (Final), 15:49580 (R;US)
Superfund analytical review and oversight. Directive (Final), 15:48707 (R;US)
Superfund: Looking back, looking ahead, 15:48706 (R;US)

Audits
Involvement of Superfund program managers in Superfund response agreement audits. Directive (Final), 15:48711 (R;US)

Compliance
Discharge of waste water from CERCLA sites into POTWS. Directive (Final), 15:49612 (R;US)

Decision Making
Results of FY '89 record of decision analysis Superfund management review implementation product. Recommendation No. 25A. Directive (Final), 15:48710 (R;US)

Demonstration Programs
Superfund innovative technology evaluation program: Technology profiles, November 1989, 15:48712 (R;US)

Directories
Site enforcement tracking system (SETS) (national). Data file, 15:48725 (R;US)

Enforcement
CERCLA off-site policy: Providing notice to facilities. Final report, 15:48708 (R;US)
Redelegation of authority under CERCLA and SARA. Directive (Final), 15:49581 (R;US)

Information Systems
Site Enforcement Tracking System (SETS) (Region 1) (for microcomputers). Data file, 15:48714 (R;US)
Site Enforcement Tracking System (SETS) (Region 2) (for microcomputers). Data file, 15:48715 (R;US)
Site Enforcement Tracking System (SETS) (Region 3) (for microcomputers). Data file, 15:48716 (R;US)
Site Enforcement Tracking System (SETS) (Region 4) (for microcomputers). Data file, 15:48717 (R;US)

Site Enforcement Tracking System (SETS) (Region 5) (for microcomputers). Data file, 15:48718 (R;US)
Site Enforcement Tracking System (SETs) (National) (for microcomputers). Data file, 15:48724 (R;US)
Site Enforcement Tracking System (SETs) (Region 6) (for microcomputers). Data file, 15:48719 (R;US)
Site Enforcement Tracking System (SETs) (Region 7) (for microcomputers). Data file, 15:48720 (R;US)
Site Enforcement Tracking System (SETs) (Region 8) (for microcomputers). Data file, 15:48721 (R;US)
Site Enforcement Tracking System (SETs) (Region 9) (for microcomputers). Data file, 15:48722 (R;US)
Site Enforcement Tracking System (SETs) (Region 10) (for microcomputers). Data file, 15:48723 (R;US)

Optimization
RI/FS improvements follow-up. Final report, 15:48709 (R;US)

Recommendations
Guide for conducting treatability studies under CERCLA. Interim report (Final), 15:48713 (R;US)

SUPERNOVA REMNANTS
Near infrared spectroscopy of the supernova remnant RCW103, 15:49770 (RA;FR)

SUPERNOVAE
A new site for the astrophysical gamma-process: Revision 1, 15:49836 (R;US)
Carbon monoxide in supernova 1987A, 15:49789 (RA;FR)
Detection of SN1986j in NGC891 at millimetre wavelengths, 15:49791 (RA;FR)
Infrared spectroscopy of supernova 1987A, 15:49779 (RA;FR)
Near infrared (1 - 4 μm) spectroscopy of SN1987 A, 15:49787 (RA;FR)
Supernova 1987A in the Large Magellanic Cloud, 15:49831 (RA;ZA)
The great supernova of 1987, 15:49840 (BA;US)
Unified geometric theory of gravitation and electromagnetism: 5. Gravitational collapse and scalar radiation, 15:49810 (R;SU;In Russian)

SUPERTANKERS
See TANKER SHIPS

SUPERVOLTAGE RADIOTHERAPY
See RADIOTHERAPY

SURFACE AIR
Krypton-85 concentration in the atmosphere, 15:49460 (RA;DE;In German)

SURFACE BARRIER DETECTORS
The use of a silicon surface barrier detector for quality assurance in diagnostic radiology, 15:49657 (RA;GB)

SURFACE BOILING
See SUBCOOLED BOILING

SURFACE CONTAMINATION
Results of the radiological survey at the Granite City Steel faciltiy, Granite City, Illinois, 15:49575 (R;US)

SURFACE WATERS
See also ESTUARIES
LAKES
PONDS
SEAS
Determination of the acid level of weakly mineralized waters, 15:49634 (R;CA)
Health assessment for Fletcher's Paint Works and Storage Facility Hazardous Waste Material, Milford, Hillsborough County, New Hampshire, Region 1. CERCLIS No. NHD981067614. Preliminary report, 15:49615 (R;US)
Health assessment for Imperial Oil Co., Inc./Champion Chemicals, Marlboro Township, Monmouth County, New Jersey, Region 2. CERCLIS No. NJD980654099. Final report, 15:49624 (R;US)
Health assessment for Kent County Landfill (Houston), Houston, Kent County, Delaware, Region 3. CERCLIS No. DED980705727. Preliminary report, 15:49535 (R;US)
Health assessment for Landfill and Development Company, Mount Holly, New Jersey, Region 2. CERCLIS No. NJD048044325. Final report, 15:49611 (R;US)
Health assessment for South Municipal Water Supply Well, Hillsborough County, Peterborough, Cheshire County, New Hampshire, Region 1. CERCLIS No. NHD980671069. Final report, 15:49616 (R;US)
Health assessment for Tex Tin Corporation, National Priorities List Site, Texas City, Texas, Region 6. CERCLIS No. TXD062113329. Preliminary report, 15:49617 (R;US)
Health assessment for Union Carbide Disposal/Red Oak Landfill Site, Red Oak, Iowa, Region 7. CERCLIS No. IAD980643509. Preliminary report, 15:49539 (R;US)
Superfund Record of Decision (EPA Region 1): New Bedford, MA. (First remedial action), March 1990, 15:49628 (R;US)
Superfund Record of Decision (EPA Region 3): C and R Battery, VA. (First remedial action), March 1990. Final report, 15:49629 (R;US)
Superfund Record of Decision (EPA Region 3): Westline, PA. (First remedial action) (amendment), March 1990, 15:49630 (R;US)

SURFACE-ACTIVE AGENTS
See SURFACTANTS

SURFACES
Bonding and interaction of molecules with surfaces, 15:49861 (RA;BR)
Effect of calcium sulfate on pool boiling of enhanced heat transfer surfaces, 15:49180 (R;US)
Secondary-electron yield measurements from metals impacted by high- velocity ions, electrons, and molecules, 15:50084 (R;US)
Tubeside evaporation of nonazeotropic refrigerant mixtures from two enhanced surfaces, 15:48773 (R;US)

SURFACTANTS
Toxicology of oil-spill cleanup agents. Final report, 15:48161 (R;US)

SURRY POWER STATION UNIT-1
See SURRY-1 REACTOR

SURRY-1 REACTOR
Radionuclide release calculations for selected severe accident scenarios: Supplemental calculations, 15:48663 (R;US)

SURVEILLANCE (RADIOACTIVITY)
See RADIATION MONITORING

SURVEY (RADIOACTIVITY)
See RADIATION MONITORING

SWEAT GLANDS
See SKIN

SWIMMING POOL REACTORS
See POOL TYPE REACTORS

SWIRL FLOW
See VORTEX FLOW

SYMBIOTIC STARS
High resolution infrared spectroscopy of symbiotic stars, 15:49780 (RA;FR)
Infrared spectroscopy of novae and related objects, 15:49778 (RA;FR)

SYMMETRY BREAKING
Chiral interface at the finite temperature transition point of QCD, 15:50048 (R;US)

SYNCHROPHASOTRONS
See SYNCHROTRONS

SYNCHROTRON OSCILLATIONS
On the possibility of oscillation damping in strong-focusing accelerator by spontaneous radiation, 15:49231 (R;SU;In Russian)

SYNCHROTRON RADIATION
Design of a wire imaging synchrotron radiation detector, 15:49322 (J;US)
Initial performance of the wire imaging synchrotron radiation detector, 15:49268 (J;US)

SYNCHROTRON RADIATION SOURCES
See also KEK PHOTON FACTORY
Manufacturing of superconducting wiggler coil, 15:49279 (R;JP;In Japanese)
Proceedings of the third users meeting for the Advanced Photon Source, 15:49224 (R;US)
The transverse displacement in a circular accelerator disturbs the hexapolar non-linearities. Application to the dynamical aperture problem, 15:49232 (R;FR;In French)

SYNCHROTRONS
See also BROOKHAVEN AGS
EREVAN SYNCHROTRON
FERMILAB ACCELERATOR
FERMILAB TEVATRON
JINR SYNCHROTRON
SATURNE
Basic circuit of synchrotron power supply on standard units, 15:49247 (R;SU)

SYNTHETIC FUELS REFINERIES
UNOCAL Parachute Creek Shale Oil Program. Environmental monitoring plan, annual report, October 1, 1988-September 30, 1989, 15:48207 (R;US)

T

T CODES
Development of THYDE-HTGR: computer code for transient thermal-hydraulics of high-temperature gas-cooled reactor, 15:48575 (R;JP)
Simulation of radionuclide retardation at Yucca Mountain using a stochastic mineralogical/geochemical model, 15:48308 (BA;US)
Simulation on reactive chemical transport in varying thermal field with reaction-flow coupling, 15:48306 (BA;US)

T-15 TOKAMAK
A time-of-flight analyzer of low energy atoms (preliminary test on the CASTOR tokamak), 15:50143 (RA;CS)
Automated system of visible and ultraviolet spectroscopy for the T-15 tokamak, 15:50142 (RA;CS;In Russian)
Charge-exchange spectroscopy in the T-15 tokamak, 15:50141 (RA;CS;In Russian)
Diagnostic system CAE T-15 and prospects of its development, 15:50136 (RA;CS;In Russian)
High-resolution spectrometer with a spherical crystal for the T-15 tokamak, 15:50137 (RA;CS;In Russian)
Investigation of edge plasma by means of Langmuir probes, 15:50148 (RA;CS;In Russian)
Neutron spectrometers for the T-15 tokamak, 15:49302 (RA;CS;In Russian)
Project of CFP plasma diagnostic system for the T-15 tokamak, 15:50144 (RA;CS;In Russian)
Results of preliminary theoretical investigations of the lower hybrid current drive in the T-15 tokamak, 15:50147 (RA;CS;In Russian)
Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak", 15:50133 (R;CS;In Russian, English)
Technological start of T-15 tokamak. The start-up diagnostic complex, 15:50134 (RA;CS;In Russian)
Two-wavelength, multi-channel, submillimeter laser interferometer for measurements of plasma density in T-15 tokamak, 15:50135 (RA;CS;In Russian)
VUV spectroscopy in the T-15 tokamak, 15:50140 (RA;CS;In Russian)
X-ray monochromator for ion temperature measurements in the T-15 tokamak, 15:50138 (RA;CS;In Russian)
X-ray spectrometer for the T-15 tokamak, 15:50139 (RA;CS;In Russian)

TANDEM ELECTROSTATIC ACCELERATORS
See also JAERI TANDEM ACCELERATOR
The main aspects of the Vivitron mechanical structure, 15:49242 (R;FR)

TANK FARMS
See STORAGE FACILITIES

TANKER SHIPS
Potential issues associated with shipping oil and gas through the Labrador Sea and Strait of Belle Isle, 15:48170 (R;CA)
Response to recommendation No. 80, Beaufort Sea environmental assessment and review panel: Final report, 1984-89, 15:48171 (R;CA)

TANKS
Technical assessment and economic study of compressed air energy storage in Japan, 15:48685 (R;JP;In Japanese)

TANTALUM 181 TARGET
Investigation of the particle stability of the isotope ^{25}O in the nuclear reactions 44 MeV/A ^{48}Ca+Ta, 15:50005 (RA;SU)
Search for strangeness-abundant quark-gluon matter in nucleus-nucleus and antiproton-nucleus interactions, 15:50042 (R;SU;In Russian)

TANTALUM ALLOYS
Study of constitution diagram aluminum-tantalum, 15:48856 (R;US)

TAR SAND TAILINGS
See OIL SAND TAILINGS

TAR SANDS
See OIL SANDS

TARGETS
See also ALUMINIUM 27 TARGET
CALCIUM 40 TARGET
CARBON 12 TARGET
COPPER 64 TARGET
DEUTERIUM TARGET
HELIUM 3 TARGET
HELIUM 4 TARGET
HYDROGEN 1 TARGET
IODINE 127 TARGET
IRON 56 TARGET
LEAD 207 TARGET
MOLYBDENUM 92 TARGET
NEON 20 TARGET
NITROGEN 15 TARGET
POLARIZED TARGETS
TANTALUM 181 TARGET
VANADIUM 51 TARGET
ZINC 68 TARGET
Manual for target thickness measurement by alpha particle irradiation, 15:50055 (R;BR;In Portuguese)

TBP
Purification of degraded TBP solvent using macroreticular anion exchange resin, 15:48222 (R;IN)

TECHNICAL SPECIFICATIONS
See SPECIFICATIONS

TECHNOLOGY TRANSFER
Proceedings [of the] Environmental research: Technology transfer conference: Volume 2. Liquid and solid waste, analytical methods, environmental socio-economics, 15:48733 (R;CA)

TELESCOPES
A large-area, scintillation telescope for heavy ions, 15:49328 (J;US)

TEMPERATURE (0065-0273 K)
See LOW TEMPERATURE

TENNESSEE
Two citizen task forces and the challenge of the evolving nuclear waste siting process, 15:48341 (BA;US)

TENSILE PROPERTIES
A continuum tensile failure model with friction, 15:49400 (R;US)

TENSILE STRENGTH
See TENSILE PROPERTIES

TERBIUM COMPLEXES
On the stability and bonding in bis(η-arene)lanthanide complexes, 15:49063 (RA;US)

TERTIARY RECOVERY
See ENHANCED RECOVERY

TEST FACILITIES
Multiloop Integral System Test (MIST): Final report: MIST Phase 4 tests, 15:48666 (R;US)
Multiloop Integral System Test (MIST): Final report: MIST phase 4 tests: Volume 11, 15:48665 (R;US)
The MERLIN programme: Pt. 2, A description of the MERLIN rig, 15:48662 (R;GB)

TEST PARTICLES
Quantum mechanics of relativistic particles in multiply connected spaces and the Aharonov-Bohm effect, 15:50095 (R;BR)

TEST WELLS
See EXPLORATORY WELLS

TESTING
See also MATERIALS TESTING

Irradiation testing of SIEMENS/KWU LWR fuel in the HFR Petten, 15:48531 (RA;FR)

TESTING (MATERIALS)
See MATERIALS TESTING

TETRACENE
1,5-disubstituted cyclooctatetraenes, 15:49062 (RA;US)

TETRACHLOROMETHANE
See CARBON TETRACHLORIDE

TEVATRON
See FERMILAB TEVATRON

TEXAS
Evaluation of unrecovered mobile oil in Texas, Oklahoma, and New Mexico, 15:48136 (BA;US)
Health assessment for Tex Tin Corporation, National Priorities List Site, Texas City, Texas, Region 6. CERCLIS No. TXD062113329. Preliminary report, 15:49617 (R;US)
Texas Barrier Islands Region ecological characterization atlas: Biological resources narrative, 15:49570 (R;US)
Texas Barrier Islands Region ecological characterization atlas: Socioeconomic and natural features narrative, 15:49569 (R;US)

TEXAS EXPERIMENTAL TOKAMAK
See TEXT DEVICES

TEXT DEVICES
Edge turbulence and transport: Text and ATF modeling, 15:50112 (R;US)

TEXTURE
Accurate representations of general textures by a set of weighted grains, 15:48887 (R;US)

TFTR DEVICE
See TFTR TOKAMAK

TFTR REACTORS
See TFTR TOKAMAK

TFTR TOKAMAK
High beta and confinement studies on TFTR: Progress report, September 25, 1989–May 24, 1990, 15:50117 (R;US)

THALLIUM
Final best demonstrated available technology (BDAT) background document for P and U thallium wastes. Volume 18, 15:49492 (R;US)

THALLIUM OXIDES
Development of high-Tc superconducting wire with high critical current density, 15:48935 (R;JP)
Preparation and structural characterization of Tl-Sr-Ca-Cu-O superconducting materials, 15:48934 (R;JP)

THERMAL DECAY TIME LOG
See NEUTRON-GAMMA LOGGING

THERMAL DECOMPOSITION
See PYROLYSIS

THERMAL ENERGY STORAGE EQUIPMENT
A 600 m^3 stratified thermal storage using sensible heat on the saclay nuclear research site (France), 15:48687 (R;FR;In French)
Latent thermal energy storage using form-stable high-density polyethylene, 15:48475 (R;JP)
Operational testing of two thermal energy storge furnaces, 15:48689 (R;CA)

THERMAL NEUTRONS
Thermal neutron absorption cross sections for igneous rocks: Newberry Caldera, Oregon, 15:48479 (R;US)

THERMAL PHOTOGRAPHY
See INFRARED THERMOGRAPHY

THERMAL POLLUTION (AIR)
See AIR POLLUTION

THERMAL POLLUTION (WATER)
See WATER POLLUTION

THERMODYNAMIC MODEL
Local dielectric effects and the calculation of thermodynamic functions of ion solvation within a born continuum approach, 15:49032 (RA;BR)

THERMODYNAMICS
[Chemical thermodynamics]: Foreign trip report, August 23, 1990–September 5, 1990, 15:49082 (R;US)

THERMOLUMINESCENT DOSEMETERS
On interpreting the results of personnel dosimeter intercomparison, 15:49301 (R;SU;In Russian)

THERMOLUMINESCENT DOSIMETRY
Neutron detection based on superheated materials, 15:49355 (J;US)

THERMONUCLEAR POWER PLANTS
Updated comparison of economics of fusion reactors with advanced fission reactors, 15:50168 (R;US)

THERMONUCLEAR REACTIONS
See also MUON-CATALYZED FUSION
Cold fusion and tritium, 15:50199 (RA;GB)
Cold fusion in palladium: the experimental results from PSI, 15:50197 (RA;GB)
On the criteria followed in the Gran Sasso measurement on cold nuclear fusion, 15:50201 (RA;GB)
Proceedings of an international symposium on muon catalysed fusion μCF - 89, held at Keble College, Oxford, 11-13 September 1989, 15:50182 (R;GB)
Response to queries regarding "Observation of cold nuclear fusion in condensed matter", 15:50200 (RA;GB)
The non-observation of cold nuclear fusion in electrolytic cells stimulated by high intensity stopped muons and pions, 15:50198 (RA;GB)

THERMONUCLEAR REACTORS
See also D-T REACTORS
Seminar of CMEA experts "Plasma diagnostics in T-15 tokamak", 15:50133 (R;CS;In Russian, English)

THERMONUCLEAR WEAPONS
See NUCLEAR WEAPONS

THERMOPLASTICS
Potential for advanced thermoplastic composites in space systems, 15:49405 (R;US)

THERMOSPHERE
Neutral and ion composition changes in the F Region over Millstone Hill during the equinox transition study, 15:49856 (R;US)
Remote sensing of the thermosphere, plasmasphere, and exosphere, 15:49361 (J;US)
Thermosphere-ionosphere coupling: An experiment in interactive modeling, 15:49850 (R;US)

THIN FILMS
Determination of hydrogen (deuterium) density profiles in thin metal films and multilayers by neutron reflection, 15:48857 (R;US)
Indentation testing of thin films and hard materials, 15:48912 (R;US)
Low temperature organometallic chemical vapor deposition (OMCVD) of rhodium and iridium thin films, 15:48938 (BA;US)
Magnetic properties of ultrathin epitaxial films of iron, 15:48861 (R;US)
Theoretical calculations of the nonlinear dielectric function of inhomogeneous thin films, 15:48972 (R;US)

THIO COMPOUNDS
See ORGANIC SULFUR COMPOUNDS

THIOALCOHOLS
See THIOLS

THIOETHERS
See SULFIDES

THIOLS
Preparation of potential radioprotective agents derived from aminothiols. Annual report, 16 July 1985-15 July 1986, 15:49706 (R;US)

THIRRING MODEL
Gauge structure, anomalies and mass generation in a three dimensional thirring model, 15:49965 (R;BR)

THORIUM 230
Results of the radiological survey at the Granite City Steel faciltiy, Granite City, Illinois, 15:49575 (R;US)

THORIUM 231
Hyperdeformed pear-shaped nuclei, 15:50015 (R;FR)

THORIUM 232
Collective bands in actinide nuclei and rare-earth elements in the SU(3) scheme, 15:50025 (R;SU;In Russian)

Results of the radiological survey at the Granite City Steel facility, Granite City, Illinois, 15:49575 (R;US)

THORIUM 233
Hyperdeformed pear-shaped nuclei, 15:50015 (R;FR)

THORIUM BROMIDES
Analysis of the $5f^1 \rightarrow 6d^1$ transitions in PaX_6^{2-} (X = Cl, Br) and $Pa^{4+}/ThBr_4$, 15:49019 (RA;US)

THORIUM HYDRIDES
X-ray photoelectron studies of thorium oxide and thorium oxide hydrate, 15:48939 (BA;US)

THORIUM OXIDES
X-ray photoelectron studies of thorium oxide and thorium oxide hydrate, 15:48939 (BA;US)

THORON
See RADON 220

THREE-BODY PROBLEM
Some dynamical properties of the linear three-particle chain, 15:50102 (R;UA;In Russian)

THULIUM COMPLEXES
On the stability and bonding in bis(η-arene)lanthanide complexes, 15:49063 (RA;US)

TIME-OF-DAY PRICING
See TIME-OF-USE PRICING

TIME-OF-FLIGHT SPECTROMETERS
A fast large-area position-sensitive time-of-flight neutron detection system, 15:49320 (J;US)
A large-area, scintillation telescope for heavy ions, 15:49328 (J;US)

TIME-OF-SEASON PRICING
See TIME-OF-USE PRICING

TIME-OF-USE PRICING
Survey of utility real-time pricing programs in the U.S, 15:48683 (R;JP;In Japanese)

TIME-TO-AMPLITUDE CONVERTERS
Information plates TP, δT and T2A for the KLYuKVA data collection system, 15:49207 (R;SU;In Russian)

TIN
Solderability of environmentally exposed Sn-plated surfaces, 15:48897 (R;US)

TIN 110
Gamma ray from highly excited ^{190}Hg and ^{110}Sn, 15:50014 (RA;JP;In Japanese)

TITANATES
Assessment of modular IGCC plants based on entrained flow coal gasification supplemental studies, 15:48489 (R;US)
Dielectric properties of fluxed barium titanate ceramics with zirconia additions, 15:48945 (J;US)

TITANIUM
[Defects in close-packed metals and alloys]: Foreign trip report, August 9, 1990–August 22, 1990, 15:48896 (R;US)

TITANIUM ALLOYS
See also TITANIUM BASE ALLOYS
Growth and deformation mechanisms of refractory-alloy hybrid materials. Final report, September 1986-September 1989, 15:48903 (R;US)
Metal-matrix composites - a promising alternative to conventional alloys, 15:48908 (R;DE)

TITANIUM BASE ALLOYS
High-resolution electron microscopy observations of athermal omega phase in Ti-Mo alloys, 15:48898 (R;US)

TITANIUM OXIDES
Epitaxial TiO_2 and VO_2 films prepared by MOCVD [metal-organic chemical vapor deposition], 15:48915 (R;US)
Picosecond charge-transfer events in the photosensitization of colloidal TiO_2, 15:48983 (J;US)

TLD (DOSEMETERS)
See THERMOLUMINESCENT DOSEMETERS

TLD (DOSIMETRY)
See THERMOLUMINESCENT DOSIMETRY

TLD SYSTEMS
See THERMOLUMINESCENT DOSEMETERS

TOBACCO
Insulation cuts curing costs, offers better kiln control, 15:48817 (R;CA)
Sealing and insulating specific areas of bulk tobacco kilns: Final report, 15:48812 (R;CA)

TOCOPHEROLS
See VITAMIN E

TOKAMAK DEVICES
See also CASTOR TOKAMAK
ITER TOKAMAK
T-15 TOKAMAK
TEXT DEVICES
An empirical scaling of the thermal diffusivity applicable to both L- and H-mode discharges, 15:50164 (R;JP)
CTR plasma engineering studies: Annual progress report, December 1, 1989–November 30, 1990, 15:50114 (R;US)
Current bubble formation by nonlinear coupling of resistive tearing modes, 15:50163 (R;JP)
Effects of compressibility, diamagnetic drift, and thermal conduction on resistive ballooning modes in the second stability regime, 15:50119 (R;US)
Electron distribution function and rate constants of elementary processes in a tokamak near-wall plasma, 15:50128 (R;SU;In Russian)
Natural current profiles in a tokamak, 15:50118 (R;US)
Theoretical and numerical studies in magnetic mirror fusion: Progress report, 15:50116 (R;US)

TOKAMAK FUSION TEST REACTOR
See TFTR TOKAMAK

TOP PARTICLES
The search for very heavy top and the fourth generation, 15:49908 (R;US)

TOPOLOGY
Manifolds, tensors and differential forms: some applications in physics, 15:50090 (R;IN)

TORSATRON STELLARATOR
See also ATF TORSATRON
Analytical representation of the geometry of helical windings for plasma devices, 15:50179 (R;UA;In Russian)
Installation of disruption instability in the Uragan-2 large-shear stellarator, 15:50160 (R;UA;In Russian)

TOTAL-ABSORPTION SPECTROMETERS
See SHOWER COUNTERS

TOUGHNESS (FRACTURE)
See FRACTURE PROPERTIES

TOXIC MATERIALS
Calculating toxic corridors. Revision. Technical report, 15:49415 (R;US)
Monitoring costs and their implications for direct dischargers in the Ontario mineral industry: Group B, industrial minerals sector, 15:49601 (R;CA)

TRACK DETECTORS (DIELECTRIC)
See DIELECTRIC TRACK DETECTORS

TRACK DETECTORS (PHOTOGRAPHIC)
See PHOTOGRAPHIC FILM DETECTORS

TRADE (NUCLEAR)
See NUCLEAR TRADE

TRANSDUCERS
Measurement of two-phase flow momentum with force transducers, 15:48645 (R;US)

TRANSFER (ELECTRON)
See ELECTRON TRANSFER

TRANSFER (HEAT)
See HEAT TRANSFER

TRANSFER (IN ENVIRONMENT)
See RADIONUCLIDE MIGRATION

TRANSFER (LINEAR MOMENTUM)
See LINEAR MOMENTUM TRANSFER

TRANSFER (MASS)
See MASS TRANSFER

TRANSISTORS
See also FIELD EFFECT TRANSISTORS
MOS TRANSISTORS
A radiation hardened SONOS/CMOS EEPROM family, 15:49367 (R;US)
Investigation of radiation stability of low-noise transistors, 15:49365 (R;SU;In Russian)

TRANSITION ELEMENT ALLOYS
Metallurgical processes in multi-component rare earth-transition metal permanent magnet alloys. Final report, 15 May 1987-14 May 1990, 15:48854 (R;US)
TRANSITION ELEMENT COMPLEXES
See also COBALT COMPLEXES
IRIDIUM COMPLEXES
MOLYBDENUM COMPLEXES
RHODIUM COMPLEXES
RUTHENIUM COMPLEXES
YTTRIUM COMPLEXES
On the way to ligating oligocyclopentadienyls: Synthesis and preliminary reactivity of the two isomeric tercyclopentadienyls and their transition-metal complexes, 15:49053 (RA;US)
Transition metal-catalyzed conversion of CO, NO, H_2, and organic molecules to fuels and petrochemicals, 15:49001 (RA;US)
TRANSITION FLOW
Experimental and theoretical studies of friction and heat transfer in rough passages: Progress report, April 15, 1990–July 31, 1990, 15:49179 (R;US)
TRANSITION RADIATION DETECTORS
Optimal transition X radiation detectors for particle identification in a wide energy range, 15:49290 (R;SU;In Russian)
TRANSMISSION (DATA)
See DATA TRANSMISSION
TRANSMISSION (HEAT)
See HEAT TRANSFER
TRANSMISSION LINES
See POWER TRANSMISSION LINES
TRANSMISSION TOWERS
See POWER TRANSMISSION TOWERS
TRANSPORT (GAMMA)
See PHOTON TRANSPORT
TRANSPORT (NEUTRON)
See NEUTRON TRANSPORT
TRANSPORT (PHOTON)
See PHOTON TRANSPORT
TRANSPORT (RADIATION)
See RADIATION TRANSPORT
TRANSPORTATION SECTOR
Assessment of costs and benefits of flexible and alternative fuel use in the US transportation sector: Technical report four: Vehicle and fuel distribution requirements, 15:48845 (R;US)
Electrical power sources inventory for Transport Canada, 15:48755 (R;CA)
TRANSPORTATION SYSTEMS
Development of transportation operations requirements: Operations planning, 15:48238 (BA;US)
Identification of facility constraints that impact transportation operations, 15:48239 (BA;US)
The transportation operations system: A description, 15:48237 (BA;US)
TRANSURANIUM WASTES
See ALPHA-BEARING WASTES
TRIAZOLES
Preparation and properties of 3-amino-5-nitro-1,2,4-triazole, 15:49392 (R;US)
TRIBUTYL PHOSPHATE
See TBP
TRICHLOROMETHANE
See CHLOROFORM
TRIGGER CIRCUITS
Request by the Resident Representative of Iraq, 15:49398 (R;XA)
TRIPLET PARTICLES
See QUARKS
TRITIUM
An investigation of the critical facility tritium monitoring, 15:48373 (R;US)
Hydrogeological investigations at the Asse salt mine, 15:48282 (RA;DE;In German)
Kinetics of the excited mesic hydrogen in the mixture of hydrogen isotopes, 15:50191 (RA;GB)
Low-level tritium measurements in groundwater samples from Stripa-Pluton (Sweden), 15:49598 (RA;DE;In German)
Method of measuring Cf_3T activity developed for laser-based tritium separation, 15:48399 (R;CA)
TRITONS
Production of high energy nuclei ^4He,^3He,^3H,^2H in interaction 10.1 GeV/c protons with Be,Al,Cu,Ta, 15:50032 (R;SU)
Relativistic corrections to energy levels of weakly bound states of mesic molecules $dd\mu$ and $dt\mu$, 15:49877 (RA;SU;In Russian)
Study of the effects in three-nucleon systems due to the violation of nuclear forces charge independence, 15:49946 (R;UA)
TRU WASTES
See ALPHA-BEARING WASTES
TRUCKS
Operational considerations in specifying legal weight vehicles for the highway transport of spent nuclear fuel, 15:48381 (BA;US)
TRX-1
See REVERSE-FIELD PINCH
TUBES
See also PRESSURE TUBES
Experimental and theoretical studies of friction and heat transfer in rough passages: Progress report, April 15, 1990–July 31, 1990, 15:49179 (R;US)
Unsteady fluid forces and fluidelastic vibration of a group of circular cylinders, 15:49177 (R;US)
TUBES (CONDUITS)
See PIPES
TUFF
An investigation of the mechanical and hydrologic behavior of tuff fractures under saturated conditions, 15:48337 (BA;US)
Diffusion barrier transport properties of unsaturated paintbrush tuff rubble backfill, 15:48314 (BA;US)
Evaluation of near-field thermal environment conditions for a spent fuel repository in tuff, 15:48320 (BA;US)
Natural radionuclides in groundwater from J-13 well at the Nevada test site, 15:48310 (BA;US)
Prototype testing for the Yucca Mountain project, 15:48335 (BA;US)
TUNGSTEN BASE ALLOYS
Corrosion and arc erosion in MHD channels: Quarterly progress report, January–March 1990, 15:48757 (R;US)
TUNGSTEN CARBIDES
Study on the fracturing of cermets in the tungsten monocarbide-cobalt system during microimpact loading, 15:48926 (R;UA;In Russian)
TUNGSTEN HYDRIDES
Reactivity of metal dihydrogen complexes: Studies of Mo and W, 15:49092 (BA;US)
TUNGSTEN OXIDES
Simultaneous particulates, NOx_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 9, July 1, 1989–September 30, 1989, 15:48511 (R;US)
TUNISIA
Agreement of 24 February 1989 between the Republic of Tunisia and the International Atomic Energy Agency for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons, 15:48391 (R;XA)
TURBINES
See also GAS TURBINES
STEAM TURBINES
WIND TURBINES
Power generation using a low power Organic Rankine Cycle, 15:48492 (R;FI;In Finnish)
TURBOMACHINERY
See also TURBINES
A computer program system for the analysis of 3-d steady flows in turbomachinery components, 15:49178 (R;DE;In German)
The application of state observers in structural dynamics, 15:48488 (RA;DE)
TURBULENT FLOW
Experimental research of local hydrodynamic characteristics of fast reactor fuel assembly peripheral zone. 6: Turbulent flow microstructure at a group displacement of the rods, 15:48585 (R;CS;In Russian)

Magnetohydrodynamic modification of the TEACH-T code and the prediction of the maximum azimuthal velocity in a conducting fluid, 15:49896 (R;US)

TWO-BODY PROBLEM
Single-time reduction of bethe-salpeter formalism for two-fermion system, 15:49966 (R;SU)

2-CHLORO-1,3-BUTADIENE
See NEOPRENE

U

U3O8
See URANIUM OXIDES U3O8

UCLBL
See LAWRENCE BERKELEY LABORATORY

UCLLL
See LAWRENCE LIVERMORE LABORATORY

UHF RADIATION (01-100 GHZ)
See RADIOWAVE RADIATION

UHF RADIATION (100-1000 MHZ)
See RADIOWAVE RADIATION

UHF RADIATION (LOWER RANGE)
See RADIOWAVE RADIATION

UHF RADIATION (UPPER RANGE)
See RADIOWAVE RADIATION

UJV
List of publications 1989, 15:50208 (R;CS;In Czech, English)

ULCC
See TANKER SHIPS

ULTRAHIGH FREQUENCY RADIATION (01-100 GHZ)
See RADIOWAVE RADIATION

ULTRAHIGH FREQUENCY RADIATION (100-1000 MHZ)
See RADIOWAVE RADIATION

ULTRAHIGH FREQUENCY RADIATION (LOWER RANGE)
See RADIOWAVE RADIATION

ULTRAHIGH FREQUENCY RADIATION (UPPER RANGE)
See RADIOWAVE RADIATION

ULTRASONIC TESTING
Fatigue crack characterization by ultrasonic inspection, 15:49189 (R;US)

ULTRAVIOLET SPECTROMETERS
VUV spectroscopy in the T-15 tokamak, 15:50140 (RA;CS;In Russian)

UNCERTAINTY
See DATA COVARIANCES

UNDERGROUND
Development of buried cable location survey system by underground rader for power distribution cables under pavements, 15:48673 (R;JP;In Japanese)

UNDERGROUND EXPLOSIONS
Environmental corrections for a neutron-induced gamma-ray spectroscopy logging system in an air-filled borehole, 15:49401 (J;US)

UNDERGROUND FACILITIES
See also MINES
WIPP
A sensitive multi-detector neutron counter used to monitor cold fusion experiments in an underground laboratory: Negative results and positive artifacts, 15:49357 (J;US)
Approach to developing a ground-motion design basis for facilities important to safety at Yucca Mountain, 15:48307 (BA;US)
Basaltic volcanic episodes of the Yucca Mountain region, 15:48296 (BA;US)
Multidisciplinary hydrologic investigations at Yucca Mountain, Nevada, 15:48300 (BA;US)
Rock mechanics aspects of the ESF design, 15:48301 (BA;US)
Smoothwall blasting planned for the underground research facility at Yucca Mountain, 15:48298 (BA;US)
Synthesis of studies for the potential of fault rupture at the proposed surface facilities, Yucca Mountain, Nevada, 15:48309 (BA;US)

UNDERGROUND MINING
Review and evaluation of main roadway intersection techniques for use in the Sydney coal field, 15:48102 (R;CA)
Tracer gas used for the mine-fire simulations. Report No. CRL 89-87(TR), 15:48101 (R;CA)

UNDERGROUND POWER TRANSMISSION
Development of buried cable location survey system by underground rader for power distribution cables under pavements, 15:48673 (R;JP;In Japanese)
Thermal instability of underground power cables, 15:48678 (R;CA)

UNDULATORS
See WIGGLER MAGNETS

UNFINISHED OILS
Vanadyl model compounds in size exclusion-inductively coupled plasma-atomic emission (SEC-ICP-AES) studies of metal complexes in heavy crude oils and residua, 15:48175 (BA;US)

UNH
Conversion of ore concentrates and reprocessed uranyl nitrate into UF_6, 15:48213 (RA;XA)

UNIFIED GAUGE MODELS
See also STANDARD MODEL
Bound states and the formalism of composite operators in gauge theories, 15:49967 (R;UA;In Russian)
Limits on compositeness of quarks and leptons from e^+e^- annihilation, 15:49977 (R;DE)

UNIFIED-FIELD THEORIES
See also KOBAYASHI-MASKAWA MATRIX
Does there exist a gravitational analogue of the electro-weak unification, 15:49919 (R;BR)

UNION OF SOVIET SOCIALIST REPUBLICS
See USSR

UNIPOLAR TRANSISTORS
See FIELD EFFECT TRANSISTORS

UNITED NATIONS
Global climate change and activities of UNEP [United Nations Environment Programme], 15:49425 (RA;US)

UNITED STATES OF AMERICA
See USA

UNIVERSE
Thermal relics: Do we know their abundances, 15:49822 (R;US)

UNIVERSITY OF CALIFORNIA LAWRENCE RADIATION LABORATORY
See LAWRENCE BERKELEY LABORATORY

URANIUM
See also NATURAL URANIUM
Compared economic features of enrichment processes, 15:48249 (RA;XA)
Comparison between the tricaprylylamine and trilaurilamine extrability in uranium and molybdenum extraction of low concentration liquors, 15:48212 (R;BR;In Portuguese)
Separation and purification of uranium product from thorium in thorex process by precipitation technique, 15:48223 (R;IN)
The linear solution for hydriding of uranium, 15:48883 (R;US)
Uranium and human diet: a literature review, 15:49710 (R;GB)
Uranium: The recalcitrant commodity, 15:48253 (RA;XA)

URANIUM 233
Separation and purification of uranium product from thorium in thorex process by precipitation technique, 15:48223 (R;IN)

URANIUM 234
Collective bands in actinide nuclei and rare-earth elements in the SU(3) scheme, 15:50025 (R;SU;In Russian)

URANIUM 235
Low-energy conversion electrons from primary fragments of uranium 235 fission by thermal neutrons, 15:50016 (R;SU;In Russian)
Reprocessing input data validation, 15:48388 (R;US)

URANIUM 236
Collective bands in actinide nuclei and rare-earth elements in the SU(3) scheme, 15:50025 (R;SU;In Russian)

URANIUM 238
Collective bands in actinide nuclei and rare-earth elements in the SU(3) scheme, 15:50025 (R;SU;In Russian)

Results of the radiological survey at the Granite City Steel faciltiy, Granite City, Illinois, 15:49575 (R;US)

URANIUM BROMIDES
Bis(bis(trimethylsilyl)cyclopentadienyl)(bromo)uranium(III)bis (t-butylisocyanide), 15:49012 (RA;US)

URANIUM CHLORIDES
Bis(bis(trimethylsilyl)cyclopentadienyl)(chloro)uranium(III)bis (trimethylsilylcyanide), 15:49013 (RA;US)
Bis[bis(t-butyl)cyclopentadienyl]uranium chloride, 15:49010 (RA;US)

URANIUM COMPLEXES
Determination of non-metallic elements in actinide complexes by oxygen flask combustion (OFC): chlorine and fluorine, 15:48989 (R;IN)
The structures of bis[bis(trimethylsilyl)-cyclopentadienyl](chloro)uranium(III)-[bis(t-butylisocyanide)] and bis[bis(trimethylsilyl)cyclopentadienyl]-(chloro)uranium(III) [bis(t-butylcyanide)], 15:49007 (RA;US)

URANIUM COMPOUNDS
See also URANIUM BROMIDES
URANIUM CHLORIDES
URANIUM NITRIDES
URANIUM SILICIDES
Bis[(bis(trimethylsilyl)cyclopentadienyl]-chloro)uranium(III) bis (2,6-dimethylphenylisocyanide), 15:49011 (RA;US)
Di-μ-oxo-bis(bis(bis(trimethylsilyl)cyclopentadienyl)uranium(IV)), 15:49009 (RA;US)
The solubility and free energy of formation at 30°C of dehydrated schoepite, $UO_3 \cdot 0.9H_2O$, 15:49560 (BA;US)
Tris[bis(trimethylsilyl)amido](trimethylsilylimido)uranium(V), 15:49008 (RA;US)

URANIUM CONCENTRATES
Conversion of ore concentrates and reprocessed uranyl nitrate into UF_6, 15:48213 (RA;XA)
Economic aspects of the PNC process, 15:48245 (RA;XA)

URANIUM DIOXIDE
Bibliographic study specifying the limits of fire risk presented by uranium dioxide powder, 15:48375 (R;FR;In French)
Certification of a uranium-238 dioxide reference material for neutron dosimetry (EC nuclear reference material 501), 15:48994 (R;FR)
Effects of water composition on the dissolution rate of UO_2 under oxidizing conditions, 15:48220 (BA;US)
Kinetics of recrystallization and fission-gas induced swelling in high burnup UO_2 and U_3Si_2 nuclear fuels, 15:48218 (R;US)
Thermophysical and thermochemical properties of fast reactor materials, 15:48872 (R;FR)

URANIUM II
See URANIUM 234

URANIUM IONS
Electron-impact ionization of U^{88+} - U^{91+}, 15:49916 (RA;US)
Work in progress, 15:49902 (RA;US)

URANIUM NITRIDES
Low temperature routes to uranium nitrides, 15:48219 (BA;US)
Tris(methylcyclopentadienyl)uranium(III)-ammonia, 15:49060 (RA;US)

URANIUM OXIDES U3O8
A study on the recovery of uranium from low grade vein deposits, 15:48254 (RA;XA)
Spanish yellow cake production by bioleaching, 15:48214 (RA;XA)

URANIUM RECYCLE
A technical and economic comparison of the conversion of natural and oxide reactor reprocessed uranium, 15:48243 (RA;XA)
Prospects for the French nuclear fuel management, 15:48247 (RA;XA)
Some economic aspects of the low enriched uranium production: Proceedings of a technical committee meeting held in Vienna, 11-14 October 1988, 15:48242 (R;XA)
The economics of uranium recycling in the LWR fuel cycle, 15:48246 (RA;XA)

URANIUM RESERVES
Uranium resources and supply-demand projections, 15:48244 (RA;XA)

URANIUM SILICIDES
Kinetics of recrystallization and fission-gas induced swelling in high burnup UO_2 and U_3Si_2 nuclear fuels, 15:48218 (R;US)
Mechanistic interpretation of an observed rate dependence of low temperature swelling of irradiated uranium silicide dispersion fuels, 15:48217 (R;US)

URANIUM X 2
See THORIUM 231

URANYL NITRATE HEXAHYDRATE
See UNH

URBAN AREAS
How renewable fuels contribute to clean air, 15:48440 (RA;CA)
Redesigning local transportation service for improved suburban mobility: The problem of accessibility for the elderly and low-income residents. Final report, 1 January 1989-31 May 1990, 15:48803 (R;US)

US DOE
See also ANL
BNL
BATTELLE PACIFIC NORTHWEST LABORATORIES
FEED MATERIALS PRODUCTION CENTER
HANFORD RESERVATION
LANL
LAWRENCE BERKELEY LABORATORY
LAWRENCE LIVERMORE LABORATORY
ORNL
SANDIA LABORATORIES
SAVANNAH RIVER PLANT
STANFORD LINEAR ACCELERATOR CENTER
WIPP
Y-12 PLANT
Managing technical information in a multi-contractor environment, 15:50255 (R;US)

US NRC
Enforcement actions: Significant actions resolved: Quarterly progress report, April–June 1990, 15:48591 (R;US)
Nuclear regulatory commission issuances, 15:48590 (R;US)
Regulatory and technical reports (abstract index journal): Second quarter, April–June 1990, 15:48588 (R;US)
Title List of Documents Made Publicly Available, July 1–31, 1990, 15:48589 (R;US)

USA
See also FEDERAL REGION I
FEDERAL REGION III
FEDERAL REGION IV
FEDERAL REGION IX
FEDERAL REGION V
FEDERAL REGION VI
FEDERAL REGION VII
FEDERAL REGION VIII
FEDERAL REGION X
Assessment of physical coal-cleaning practices for sulfur removal. Final report, April 1986-January 1990, 15:48073 (R;US)
Climate change and US water resources, 15:49434 (RA;US)
Modeled sulfur deposition trends since 1990 in North America, 15:49456 (R;US)
Review and evaluation of main roadway intersection techniques for use in the Sydney coal field, 15:48102 (R;CA)
Summary of the NAPAP state of science report on deposition monitoring in North America, 1979–1987, 15:49457 (R;US)
Texts of joint USA-USSR statements following the summit meeting in Washington, D.C., 31 May - 3 June 1990, 15:48848 (R;XA)
U.S. regulatory environment, 15:48738 (RA;CA)

USSR
Texts of joint USA-USSR statements following the summit meeting in Washington, D.C., 31 May - 3 June 1990, 15:48848 (R;XA)

USTAV JADERNYCH VYZKUMU
See UJV

UTERINE CERVIX CARCINOMA
See CARCINOMAS

V

V CODES
Injector and valve train friction studies: Cummins L-10 engine: Progress report, October 1, 1988–December 31, 1989, 15:48836 (R;US)

VACUUM EVAPORATION
MONT3E: A Monte Carlo electron heat transfer code, 15:50088 (R;US)

VALENCE ELECTRONS
See ELECTRONS

VALVES
Guide for the application and use of valves in power plant systems: Final report, 15:48602 (R;US)

VAN DER WAALS FORCES
Tunable far-infrared laser spectroscopy of van der Waals bonds: Extended measurements on the lowest Σ bend of ArHCl, 15:49136 (RA;US)
Tunable far-infrared laser spectroscopy of van der Waals bonds: Extended measurements on the lowest Σ bend of ArHCl, 15:49000 (RA;US)
Tunable far-infrared laser spectroscopy of van der Waals bonds: Vibration-rotation-tunneling spectra of Ar-H_2O, 15:49139 (RA;US)
Tunable far-infrared laser spectroscopy of van der Waals bonds: Vibrational-rotation-tunneling spectra of Ar-H_2O, 15:49047 (RA;US)

VANADIUM
Final best demonstrated available technology (BDAT) background document for vanadium-containing wastes (P119 and P120). Volume 19, 15:49493 (R;US)

VANADIUM 51 TARGET
Complex fragment emission in binary and multifragment decay of very hot nuclear systems, 15:50001 (R;US)

VANADIUM BASE ALLOYS
Relationship of microstructure and tensile properties for neutron-irradiated vanadium alloys, 15:50167 (R;US)
The function of the HFR, Petten, in the development of plasma facing components for fusion reactors, 15:50172 (RA;FR)

VANADIUM OXIDES
Epitaxial TiO_2 and VO_2 films prepared by MOCVD [metal-organic chemical vapor deposition], 15:48915 (R;US)
Simultaneous particulates, NOx_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 9, July 1, 1989–September 30, 1989, 15:48511 (R;US)

VAPOR JET EJECTORS
Study of asymmetric supersonic jet flow for ejectors, 15:48805 (R;US)

VARIATIONAL METHODS
Accuracy-weighted variational principle for degenerate continuum states, 15:50192 (RA;GB)

VAX COMPUTERS
See DEC COMPUTERS

VECTOR MESONS
Quantum chromodynamics with infinite number of vector mesons, 15:49941 (R;SU)

VEGETATION
See PLANTS

VEHICLES
See also AUTOMOBILES
ELECTRIC-POWERED VEHICLES
SPACE VEHICLES
TRUCKS
Decontamination and decommissioning facility environmental assessment, Feed Materials Production Center, Fernald, Ohio, 15:48261 (R;US)
Vehicle research for future fuels, 15:48843 (RA;CA)

VENTILATION
Energy conservation and hospital hygiene, 15:48785 (R;FI;In Finnish)
The development of an integrating tracer gas method for ventilation measurements, 15:48796 (R;FI;In Finnish)

VENTILATION DUCTS
See VENTILATION

VENTILATION SYSTEMS
Tracer gas used for the mine-fire simulations. Report No. CRL 89-87(TR), 15:48101 (R;CA)

VENUS PLANET
Geometrical and dynamical characteristics of the Earth, the Moon and Terrestrial planets. Part 1: 1.Topographic surfaces and Gravitational fields, 15:49812 (R;UA;In Russian)

VERSENE
See EDTA

VERY HIGH FREQUENCY RADIATION
See RADIOWAVE RADIATION

VESSELS
See CONTAINERS

VESSELS (CHEMICAL REACTIONS)
See CHEMICAL REACTORS

VESSELS (PRESSURE)
See PRESSURE VESSELS

VESSELS (REACTOR)
See REACTOR VESSELS

VHF RADIATION
See RADIOWAVE RADIATION

VIET NAM
Agreement of 2 October 1989 between the Socialist Republic of Viet Nam and the International Atomic Energy Agency for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons, 15:48390 (R;XA)

VINOFLEX
See POLYVINYLS

VINYL CYANIDE
See ACRYLONITRILE

VINYL RADICALS
Work in progress, 15:49049 (RA;US)

VINYLIDENE RADICALS
Work in progress, 15:49049 (RA;US)

VIRGINIA
Health assessment for Abex Corporation, Portsmouth, Elizabeth County, Virginia, Region 3. CERCLIS No. VAD980551683. Preliminary report, 15:49582 (R;US)
Superfund Record of Decision (EPA Region 3): C and R Battery, VA. (First remedial action), March 1990. Final report, 15:49629 (R;US)

VISITOR CENTERS
See PUBLIC BUILDINGS

VITAMIN E
Dermal penetration and systemic distribution of ^{14}C-labeled vitamin E human skin grafted athymic nude mice, 15:49656 (R;US)

VLCC
See TANKER SHIPS

VOLATILE MATTER
Performance evaluation of a groundwater and soil gas remedial action, 15:49566 (R;US)

VOLCANIC ROCKS
Organic chemistry of mantle-derived xenoliths: Assessing the possibilities for deep sources of natural gas. Biennial report, November 1987-November 1989, 15:48179 (R;US)

VOLTAGE
See ELECTRIC POTENTIAL

VOLTAIC CELLS
See ELECTRIC BATTERIES

VOLTMETERS
Amplitude detector, 15:49255 (R;SU;In Russian)

VORTEX FLOW
Synthesis of oneparticle excitation from two giant quantum monopoles, 15:50093 (R;SU;In Russian)

W

W CODES
Data quality assurance controls through the WIPP in situ data acquisition, analysis and management system, 15:48368 (BA;US)

WARFARE
Nuclear-effects model embedded stochastically in simulation (NEMESIS) summary report. Technical paper, 15:49404 (R;US)

WASHINGTON
Stratigraphy, sedimentology and petroleum source rock potential of the Georgia Basin, southwest British Columbia and northwest Washington State, 15:48129 (RA;CA)

WASHOUT
Modeled sulfur deposition trends since 1990 in North America, 15:49456 (R;US)
Summary of the NAPAP state of science report on deposition monitoring in North America, 1979–1987, 15:49457 (R;US)

WASTE DISPOSAL
See also RADIOACTIVE WASTE DISPOSAL
SANITARY LANDFILLS
Liquid effluent study project plan: Environmental and waste management: Revision 2, 15:48293 (R;US)

WASTE FORMS
A waste package strategy for regulatory compliance, 15:48321 (BA;US)
MITT; International in-situ testing of simulated HLW forms: Preliminary analysis of SRL 165/TDS waste glass and metal systems, 15:48319 (BA;US)
Mass-transfer anaylsis of waste packages containing defense waste processing facility glass as a waste form, 15:48315 (BA;US)
Modified sulphur cement: A low porosity encapsulation material for low, medium and alpha waste, 15:48274 (R;FR)
Prototype heater test of the environment around a simulated waste package, 15:48332 (BA;US)
Status of integrated performance assessment of the waste packages and engineering barrier system, 15:48316 (BA;US)

WASTE ISOLATION PILOT PLANT
See WIPP

WASTE MANAGEMENT
See also RADIOACTIVE WASTE MANAGEMENT
WASTE DISPOSAL
WASTE TRANSPORTATION
Development and test case application of a waste minimization project evaluation method, 15:48726 (R;US)
Nonradioactive dangerous waste landfill closure/postclosure plan, 15:48263 (R;US)
Planning for future waste storage and transport requirements, 15:48825 (R;US)
Report and recommendations regarding the environmental-assessment report for the proposed Point Aconi electrical generating station, 15:48099 (R;CA)
Report of the PCB Working Group, 15:49576 (R;CA)

WASTE SOLUTIONS
See LIQUID WASTES

WASTE TRANSPORTATION
Transporting spent nuclear fuel: A framework for decision-making, 15:48232 (R;US)

WASTE WATER
Advanced wastewater treatment, 15:48092 (RA;US)
Anaerobic fluid-bed treatment of coal conversion wastewater: Tenth quarterly technical progress report, November 15, 1988–February 15, 1988, 15:48093 (R;US)
Best demonstrated available technology (BDAT) background document for U and P wastes and multi-source leachate (F039). Volume A. Wastewater forms of organic U and P wastes and multi-source leachate (F039) for which there are concentration-based treatment standards. Final report, 15:49503 (R;US)
Discharge of waste water from CERCLA sites into POTWS. Directive (Final), 15:49612 (R;US)
Final best demonstrated available technology (BDAT) background document for F006 waste waters (Addendum). Volume 13, 15:49487 (R;US)
Final best demonstrated available technology (BDAT) background document for K061 (Addendum). Volume 9, 15:49483 (R;US)
Treatment standards for nonwaste-water and waste-water forms of K044, K045, and K047. Volume 2. Final report, 15:49500 (R;US)

WASTE-FUELED POWER PLANTS
See REFUSE-FUELED POWER PLANTS

WASTEFORMS
See WASTE FORMS

WASTES
See also INDUSTRIAL WASTES
LIQUID WASTES
MUNICIPAL WASTES
RADIOACTIVE WASTES
SOLID WASTES
Development and test case application of a waste minimization project evaluation method, 15:48726 (R;US)
Nonradioactive dangerous waste landfill closure/postclosure plan, 15:48263 (R;US)

WATER
See also GROUND WATER
HEAVY WATER
WASTE WATER
CORQUENCH: A model for gas sparging-enhanced melt-water, film boiling heat transfer, 15:48644 (R;US)
Development of water purification technologies for intensive fish culture. 2.: Factors affecting nitrification in marine biological filter system, 15:49590 (R;JP;In Japanese)
Effect of hydrogen-water atmospheres on corrosion and flexural strength of sintered α-silicon carbide, 15:48944 (J;US)
Hanford Environmental Dose Reconstruction Project: Monthly report, August 1990, 15:49546 (R;US)
High-resolution photoionization spectrum of water molecules in a supersonic beam, 15:49135 (RA;US)
Near-critical NaCl-H_2O: An equation of state and discussion of anomalous properties, 15:49041 (RA;US)
SWAAM-code development and verification and application to steam generator designs, 15:48581 (R;US)
Tunable far-infrared laser spectroscopy of van der Waals bonds: Vibration-rotation-tunneling spectra of Ar-H_2O, 15:49139 (RA;US)
Tunable far-infrared laser spectroscopy of van der Waals bonds: Vibrational-rotation-tunneling spectra of Ar-H_2O, 15:49047 (RA;US)

WATER COOLANT
See WATER

WATER COOLED GRAPHITE MODERATED REACTORS
See LWGR TYPE REACTORS

WATER DISTRIBUTION
See WATER SUPPLY

WATER HEATERS
See also SOLAR WATER HEATERS
Thermal performance and delivery capability of an electric water heater with a non-pressurized plastic tank, 15:48786 (R;CA)

WATER MODERATOR
See WATER

WATER POLLUTION
Pollution load on the gulf of Finland in 1982-1984, 15:49636 (R;FI)
The optical parametrization of an aerial multispectral camera, 15:49599 (R;FI)
US Mussel Watch Program: Transuranic element data from Woods Hole Oceanographic Institution 1976-1983. Technical report, 15:49610 (R;US)

WATER QUALITY
Canada Brick Quarry Ground Water Survey 8th annual report, 1988-1989, 15:49605 (R;CA)

WATER SOLUTIONS
See AQUEOUS SOLUTIONS

WATER SOURCE HEAT PUMPS
Development of an operating aid device for ground water heat pump system, 15:48768 (R;FR;In French)
Engineering manual for the design and installation of ground and water source heat pump systems: Volume 1, 15:48769 (R;CA)
Installer's manual for the design and installation of ground and water source heat pump systems: Volume 2, 15:48770 (R;CA)

WATER SUPPLY
Radon-removal techniques for small community public water supplies, 15:49633 (R;US)
WATER TABLES
Red Canyon wash infiltration studies, 15:49592 (R;US)
Well network and measurement schedules for monitoring water-level changes beneath the separations area of the Hanford Site, 15:49741 (R;US)
WATER VAPOR
Calculation of transport and radiation properties of flue gases, 15:49463 (R;FI;In Finnish)
WATER WELLS
Health assessment for Radiation Technology, Inc., Rockaway, Morris County, New Jersey, Region 2. CERCLIS No. NJD047684451. Final report, 15:49625 (R;US)
Well network and measurement schedules for monitoring water-level changes beneath the separations area of the Hanford Site, 15:49741 (R;US)
WATERBORNE PARTICLES
See PARTICULATES
WATSON METHOD
See SOMMERFELD-WATSON THEORY
WAVE FORMS
A hybrid pulse forming technique, 15:49220 (R;US)
WAVE POWER
Wave force experiments at the Christchurch Bay Tower with simulated hard marine fouling, 15:49197 (R;GB)
WAVE PROPAGATION
Elementary inversion, energy velocity, and a generalized Sommerfeld theorem, 15:50097 (R;US)
WAVEFORMS
See WAVE FORMS
WAZ 16
See NICKEL BASE ALLOYS
WEAPONS
See also CHEMICAL WARFARE AGENTS
NUCLEAR WEAPONS
IGES efficiency evaluation, 15:50244 (R;US)
WECS
See WIND TURBINES
WELDED JOINTS
BWR [Boiling Water Reactor] Owners Group Intergranular Stress Corrosion Cracking Research Program: Executive summary: Phase 2 (1984–1988): Final report, 15:48528 (R;US)
Fabrication of axial stress corrosion cracks in Alloy 182 weld materials: Final report, 15:48529 (R;US)
Metallurgical investigation of main steam line weldment cracking, Lakeview TGS [thermal generating station], 15:48494 (R;CA)
Robotic inspection of prototype titanium diffusion-bond final-closure weld: Final report, 15:48235 (R;CA)
WELDS
See WELDED JOINTS
WELL STIMULATION
Fireflood ignition devices and methods, 15:48200 (J;US)
WESTERN EUROPE
See also FRANCE
LUXEMBOURG
SPAIN
Spent fuel and high-level waste management in selected countries: Trends and issues, 15:48346 (BA;US)
WESTERN REGION
See FEDERAL REGION IX
WET DEPOSITION
See WASHOUT
WET-TYPE COOLING TOWERS
See COOLING TOWERS
WHO
Quality assurance and the World Health Organization initiative of 'Health for All' (Diagnostic radiology.), 15:49666 (RA;GB)
WIGGLER MAGNETS
Manufacturing of superconducting wiggler coil, 15:49279 (R;JP;In Japanese)
WILDERNESS AREAS
See NATURE RESERVES
WIND
Soil erosion rates from mixed soil and gravel surfaces in a wind tunnel, 15:49584 (R;US)
WIND ENERGY CONVERSION SYSTEMS
See WIND TURBINES
WIND GENERATORS
See WIND TURBINES
WIND TUNNELS
Soil erosion rates from mixed soil and gravel surfaces in a wind tunnel, 15:49584 (R;US)
WIND TURBINES
See also HORIZONTAL AXIS TURBINES
Dynamic test of a 9m diameter wind turbine, 15:48480 (R;FR;In French)
Performance and cost projections for advanced wind turbines, 15:48483 (R;US)
Putting into service the RFO wind turbine at the CNEEL 15:48481 (R;FR;In French)
Software to estimate the energy production of wind turbine, 15:48482 (R;FR;In French)
WIPP
Data quality assurance controls through the WIPP in situ data acquisition, analysis and management system, 15:48368 (BA;US)
Preliminary model of repository chemistry for the Waste Isolation Pilot Plant, 15:48288 (R;US)
Waste Isolation Pilot Plant site specific plan: Revision 2, 15:48260 (R;US)
WOMEN
Guide for the preparation of proposals for the pre-freshman enrichment program, PREP, 1991, 15:48834 (R;US)
WOOD
Anecdotal history of acoustic emission from wood, 15:50104 (R;US)
High pressure thermobalance device application to the gasification of char obtained from tropical wood, 15:48433 (RA;LU)
Thermal conversion of biomass to liquids by the Waterloo Fast Pyrolysis Process, 15:48422 (RA;LU)
WOOD ALCOHOL
See METHANOL
WOOD BURNING APPLIANCES
See also WOOD BURNING FURNACES
Accelerated sample processing 1988-89. Phase 3, Northeast Cooperative Woodstove study: Final report, 15:48441 (R;CA)
WOOD BURNING FURNACES
Frequency profiles of residential wood burning for the northwestern United States, 15:48442 (R;US)
WOOD FUELS
Frequency profiles of residential wood burning for the northwestern United States, 15:48442 (R;US)
Handbook for small-to-medium size fuelwood chipping operations, 15:48412 (R;CA)
Relationship of fuel size and spacing to combustion characteristics of laboratory fuel cribs. Forest Service research paper, 15:48437 (R;US)
WOOD PRODUCTS INDUSTRY
See also PAPER INDUSTRY
Utilization of resources of the wood pulping industry - a holistic view, 15:48826 (RA;FI)
WORLD HEALTH ORGANIZATION
See WHO
WWER TYPE REACTORS
Activities in the field of nuclear power engineering in Poland, 15:48564 (RA;XA)
Analysis of bypass lines efficiency in WWER-440, 15:48555 (RA;XA)
Analysis of loop asymmetry in Paks nuclear power plant in the event of a cold leg break, 15:48557 (RA;XA)
Comparison of PMK-NVH experimental results in the event of 7.4% cold and hot leg breaks, 15:48548 (RA;XA)
Computer aided safety analysis 1989: Proceedings of a technical committee/workshop held in Berlin, 17-21 April 1989, 15:48653 (R;XA)

Emergency operating procedures for SGTR sequence, 15:48552 (RA;XA)
Experience of participants from the German Democratic Republic in DBA analysis for WWERs in the framework of the IAEA regional programme RER/9/004, 15:48546 (RA;XA)
IAEA activities in computer aided safety analysis, 15:48519 (RA;XA)
Important conclusions from intermediate cold leg LOCA analysis of WWER 440 with RELAP4/MOD6 and SLAP, 15:48559 (RA;XA)
Post-test calculation of SPE-2 with RELAP5/MOD2, 15:48549 (RA;XA)
Reactor reliability research in Hungary in 1988, 15:48563 (RA;XA)
Safety of the advanced WWER-1000 in condition of failure of the emergency protection system, 15:48554 (RA;XA)
Thermohydraulic analysis for supporting PSA of SB LOCA in WWER-440, 15:48551 (RA;XA)

X

X RADIATION
Performance studies of a multiwire chamber, with 1 mm anode wire spacing, to be used for 2-D position-sensitive detection of x-rays, 15:49326 (J;US)

X-2830 RESONANCES
See MESONS

X-RAY DETECTION
The HgI_2 energy dispersive x-ray array detectors and minaturized processing electronics project, 15:49325 (J;US)

X-RAY DIFFRACTOMETERS
Proposal of a crossed Bonse-Hart type camera at E.S.R.F. for very high resolution X-Ray diffraction and very low angle scattering, 15:49284 (R;FR;In French)

X-RAY EQUIPMENT
See also X-RAY SOURCES
X-RAY TUBES

Biomedical Radiography
A protocol for the commissioning and routine testing of mammographic X-ray systems, 15:49675 (RA;GB)
An electronic instrument for high-voltage measurements of an X-ray unit for mammography, 15:49678 (RA;GB)
Assessment of a Shimadzu/medical X-ray supplies basic radiographic installation, 15:49694 (R;GB)
Assessment of a Siemens basic radiological installation, 15:49695 (R;GB)
Assessment of the Hitachi Sirius 125 B mobile X-ray Unit at three hospitals, 15:49696 (R;GB)
Field size and centring for conventional X-ray equipment, 15:49670 (RA;GB)
Mandatory quality assurance programmes for diagnostic radiology facilities in Ontario, Canada: Minimum requirements and limiting values, 15:49664 (RA;GB)
Procuring, maintaining and using equipment: the key issues in controlling exposure to patients, 15:49661 (RA;GB)
Proposed limiting values for performance criteria in acceptance testing of diagnostic X-ray equipment in the Federal Republic of Germany, 15:49662 (RA;GB)
Quality assurance and the World Health Organization initiative of 'Health for All' (Diagnostic radiology.), 15:49666 (RA;GB)
Quality control of dental X-ray units, 15:49679 (RA;GB)
Report on the use of the Palomex Vision One (Alpha-III) mammographic unit for breast cancer screening, 15:49697 (R;GB)
Report on the use of the Senographe 600TS (SENIXHF) mammographic unit for breast cancer screening, 15:49698 (R;GB)
Screening with mammography - what quality is required and how is it checked?, 15:49676 (RA;GB)
The Northern Regional Programme for the acceptance testing of X-ray equipment, 15:49663 (RA;GB)

Comparative Evaluations
Assessment of the Hitachi Sirius 125 B mobile X-ray Unit at three hospitals, 15:49696 (R;GB)

Dentistry
Quality control of dental X-ray units, 15:49679 (RA;GB)

Evaluation
Assessment of a Shimadzu/medical X-ray supplies basic radiographic installation, 15:49694 (R;GB)
Assessment of a Siemens basic radiological installation, 15:49695 (R;GB)
Report on the use of the Palomex Vision One (Alpha-III) mammographic unit for breast cancer screening, 15:49697 (R;GB)
Report on the use of the Senographe 600TS (SENIXHF) mammographic unit for breast cancer screening, 15:49698 (R;GB)

Fluoroscopy
Image field size and beam collimation in fluoroscopic equipment, 15:49669 (RA;GB)

Mammary Glands
A protocol for the commissioning and routine testing of mammographic X-ray systems, 15:49675 (RA;GB)
An electronic instrument for high-voltage measurements of an X-ray unit for mammography, 15:49678 (RA;GB)
Report on the use of the Palomex Vision One (Alpha-III) mammographic unit for breast cancer screening, 15:49697 (R;GB)
Report on the use of the Senographe 600TS (SENIXHF) mammographic unit for breast cancer screening, 15:49698 (R;GB)
Screening with mammography - what quality is required and how is it checked?, 15:49676 (RA;GB)

Quality Assurance
A protocol for the commissioning and routine testing of mammographic X-ray systems, 15:49675 (RA;GB)
Field size and centring for conventional X-ray equipment, 15:49670 (RA;GB)
Mandatory quality assurance programmes for diagnostic radiology facilities in Ontario, Canada: Minimum requirements and limiting values, 15:49664 (RA;GB)
Procuring, maintaining and using equipment: the key issues in controlling exposure to patients, 15:49661 (RA;GB)
Proposed limiting values for performance criteria in acceptance testing of diagnostic X-ray equipment in the Federal Republic of Germany, 15:49662 (RA;GB)
Quality assurance and the World Health Organization initiative of 'Health for All' (Diagnostic radiology.), 15:49666 (RA;GB)
Screening with mammography - what quality is required and how is it checked?, 15:49676 (RA;GB)
The Northern Regional Programme for the acceptance testing of X-ray equipment, 15:49663 (RA;GB)

Quality Control
An electronic instrument for high-voltage measurements of an X-ray unit for mammography, 15:49678 (RA;GB)
Organizing quality control programmes, 15:49660 (RA;GB)
Quality control of dental X-ray units, 15:49679 (RA;GB)

Who
Quality assurance and the World Health Organization initiative of 'Health for All' (Diagnostic radiology.), 15:49666 (RA;GB)

X-RAY SOURCES
Superconducting x-ray lithography source Phase 1 (XLS) safety analysis report, 15:49276 (R;US)
The Brookhaven Superconducting X-Ray Lithography Source (SXLS), 15:49275 (R;US)

X-RAY SPECTROMETERS
An improved operating mode for a Si(Li) x-ray spectrometer, 15:49330 (J;US)
High-resolution spectrometer with a spherical crystal for the T-15 tokamak, 15:50137 (RA;CS;In Russian)
X-ray monochromator for ion temperature measurements in the T-15 tokamak, 15:50138 (RA;CS;In Russian)
X-ray spectrometer for the T-15 tokamak, 15:50139 (RA;CS;In Russian)
X-ray spectrometry in vivo a Si(Li)-NaI(T1) detector, 15:49352 (J;US)

X-RAY TUBES
Determination of high voltage: Methods of measurement, practicality, accuracy and regulations concerning tolerances, 15:49673 (RA;GB)

X-ZERO RESONANCES
See ETA PRIME-958 MESONS

XENON
Large collective lamb shifts in high pressure noble gases, 15:49871 (R;US)
XENON 132 REACTIONS
Central collisions at the fermi energy, 15:50012 (R;FR)
XYLANS
Synthesis of cell wall xylans and glucans by golgi membranes, 15:49649 (J;US)

Y

Y*RESONANCES
See BARYONS
Y-12 PLANT
A process monitoring strategy for a Precision Flexible Manufacturing System, 15:49169 (R;US)
YELLOW CAKE
See URANIUM OXIDES U3O8
YEREVAN SYNCHROTRON
See EREVAN SYNCHROTRON
YIELD (FISSION)
See FISSION YIELD
YTTERBIUM 172
Description of low-lying vibrational $K^{\pi} \neq 0^{+}$ states of deformed nuclei in the quasiparticle-phonon nuclear model, 15:50041 (R;SU)
YTTERBIUM COMPLEXES
On the stability and bonding in bis(η-arene)lanthanide complexes, 15:49063 (RA;US)
YTTRIUM ALUMINIUM GARNETS
See ALUMINIUM OXIDES
YTTRIUM BORIDES
$(Me_5C_5)_2Yb(\mu\text{-}H_3B)(PMe_3)$: A complex with a near-linear BH_3 bridging group, 15:49016 (RA;US)
YTTRIUM COMPLEXES
Electron-transfer chemistry of $(Me_5C_5)_2Yb$: Cleavage of diorganoperoxide and related chalcogenides to give $(Me_5C_5)_2Yb(ER)(L)$ where e is O, S, Se, or Te and L is a Lewis Base; crystal structure of $(Me_5C_5)_2Yb(TePh)(NH_3)$, 15:49018 (RA;US)
Reaction of $(Me_5C_5)_2Yb$ with fluorocarbons: Formation of $(Me_5C_5)_4Yb_2(\mu\text{-}F)$ by intermolecular C-F activation, 15:49017 (RA;US)
The electronic structure of organometallic complexes of the f elements - XXIII. Interpretation of the magnetochemical and optical data of a tetrahydrofuran adduct derived from tris(η^5 cyclopentadienyl)-ytterbium(III), 15:49064 (RA;US)
YTTRIUM FLUORIDES
Reaction of $(Me_5C_5)_2Yb$ with fluorocarbons: Formation of $(Me_5C_5)_4Yb_2(\mu\text{-}F)$ by intermolecular C-F activation, 15:49017 (RA;US)
YTTRIUM OXIDES
Development of high-Tc superconducting wire with high critical current density, 15:48935 (R;JP)
Experimental studies of effect of high current pulse electron and carbon ion beams on high temperature Y-Ba-Cu-O, Bi-Ca-Sr-Cu-O superconductors, 15:50078 (R;SU;In Russian)
Fabrication of composite high temperature superconductor wires from Ag/$YBa_2Cu_3O_x$ power produced by $AgNO_3$ decomposition, 15:48901 (R;US)
In-situ transmission electron microscopy and computer simulation study of the kinetics of oxygen loss in $YBa_2Cu_3O_z$, 15:48932 (R;US)
International workshop on ion beam modification and processing of high-Tc superconductors: Physics and devices: Program and abstracts, 15:48905 (R;GB)
On the electronic structure of high temperature superconductors: Nonalloyed CuOsub 2 plane, 15:50077 (R;SU;In Russian)
Processing of $YBa_2Cu_3O_7$ tapes from a molten salt precursor, 15:48924 (R;US)
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 8, April 1, 1989–June 30, 1989, 15:48510 (R;US)
Thermodynamic critical field of $Y_1Ba_2Cu_3O_7$, 15:48921 (R;US)
$YBa_2Cu_3O_x$ composites with improved toughness and strength, 15:48916 (R;US)
YTTRIUM PHOSPHATES
Electron exchange between potassium bis(t-butyl(8)annulene)ytterbate(II) and potassium bis(t-butyl(8)annulene)ytterbate(III), 15:49061 (RA;US)
YTTRIUM TELLURIDES
Bis(bis(pentamethylcyclopentadienyl)Ytterbium(III)) ditelluride, 15:49015 (RA;US)
YUCCA MOUNTAIN
Geologic Models
Modeling of coupled heat-mass stress effects in geologic media, 15:48342 (BA;US)
Geophysics
Concepts in prototype testing for in situ geomechanical investigations at Yucca Mountain, 15:48333 (BA;US)
The application of vertical seismic profiling and cross-hole tomographic imaging for fracture characterization at Yucca Mountain, 15:48330 (BA;US)
Radioactive Waste Disposal
A description and status of the Yucca Mountain Project repository sealing program, 15:48323 (BA;US)
Combined analytical/numerical approaches to solving fluid flow problems in the unsaturated zone at Yucca Mountain, 15:48338 (BA;US)
The use of performance assessments in Yucca Mountain repository waste package design activities, 15:48354 (BA;US)
Radioactive Waste Facilities
A waste package strategy for regulatory compliance, 15:48321 (BA;US)
Approach to developing a ground-motion design basis for facilities important to safety at Yucca Mountain, 15:48307 (BA;US)
Basaltic volcanic episodes of the Yucca Mountain region, 15:48296 (BA;US)
Computed distributions of residual shaft drilling and drift construction water in the exploratory facilities at Yucca Mountain, Nevada, 15:48349 (BA;US)
Initiating event identification and screening for nuclear waste repository preclosure risk assessment, 15:48378 (BA;US)
Linkage between site characterization program and performance and design data needs, 15:48359 (BA;US)
Managing local socioeconomic impacts through project management policies concerning subsidized transportation, site access, and on-site housing, 15:48313 (BA;US)
Multi-dimensional modeling of unsaturated flow in the vicinity of exploration shafts and fault zones at Yucca Mountain, Nevada, 15:48347 (BA;US)
Multidisciplinary hydrologic investigations at Yucca Mountain, Nevada, 15:48300 (BA;US)
Natural radionuclides in groundwater from J-13 well at the Nevada test site, 15:48310 (BA;US)
On-site representation and oversight: A special role for the state of the Nevada and Nye County in the civilian radioactive waste management program, 15:48312 (BA;US)
One-dimensional radionuclide transport under time-varying conditions, 15:48305 (BA;US)
Overview of the U.S. Department of Energy's PACE-90 geologic repository performance assessment exercise activity, 15:48355 (BA;US)
Preclosure safety analysis for a prospective Yucca Mountain conceptual design repository, 15:48317 (BA;US)
Prelimary methodology for design of stable drifts for the Yucca Mountain Project, 15:48297 (BA;US)
Prototype testing for the Yucca Mountain project, 15:48335 (BA;US)
Risk perspective on potential releases of ^{14}C from the geologic repository at Yucca Mountain, 15:48384 (BA;US)
Role of underground testing to determine suitability of Yucca Mountain as a potential repository site, 15:48299 (BA;US)
Simulation of radionuclide retardation at Yucca Mountain using a stochastic mineralogical/geochemical model, 15:48308 (BA;US)

Smoothwall blasting planned for the underground research facility at Yucca Mountain, 15:48298 (BA;US)
Status of integrated performance assessment of the waste packages and engineering barrier system, 15:48316 (BA;US)
Synthesis of studies for the potential of fault rupture at the proposed surface facilities, Yucca Mountain, Nevada, 15:48309 (BA;US)
Ventilation design for the Exploratory Shaft Facility Yucca Mountain Project, 15:48376 (BA;US)

Radioactive Waste Storage
Fabrication and closure development of nuclear waste containers for storage at the Yucca Mountain, Nevada repository, 15:48369 (BA;US)

Site Characterization
Environmental program overview for a high-level radioactive waste repository at Yucca Mountain (Yucca Mountain Project), 15:48268 (R;US)
Yucca Mountain Project far-field sorption studies and data needs, 15:48284 (R;US)

YUKON TERRITORY
Uppermost Devonian and lower Carboniferous stratigraphy, sedimentation, and diagenesis, southwestern District of Mackenzie and southeastern Yukon Territory (NTS 95 B, C, F, and G), 15:49736 (R;CA)

Z

Z PINCH DEVICES (LINEAR)
See LINEAR Z PINCH DEVICES

ZEA MAYS
See MAIZE

ZEOLITES
Improved Fischer-Tropsch Synthesis catalysts for indirect coal liquefaction: Quarterly technical progress report No. 8, 1 July–30 September 1987, 15:48075 (R;US)

ZET PINCH
See LONGITUDINAL PINCH

ZINC
Work in progress, 15:49100 (RA;US)

ZINC 68 TARGET
Detection and experimental investigation of α-particle Wolf-Bragg scattering on quasicrystalline atomic nuclei, 15:49990 (R;SU;In Russian)

ZINC COMPOUNDS
See also ZINC OXIDES
ZINC SULFIDES
ZINC TELLURIDES
Assessment of modular IGCC plants based on entrained flow coal gasification supplemental studies, 15:48489 (R;US)

ZINC OXIDES
Spatially resolved Raman spectroscopy in the study of transformed zones in PSZ, 15:49077 (RA;US)

ZINC SULFIDES
A more rugged ZnS(Ag) alpha scintillation detector, 15:49564 (J;US)

ZINC TELLURIDES
Optical characterization of CdZnTe/CdTe strained quantum wells, 15:48978 (R;US)

ZINC-AIR BATTERIES
Electrical and electrochemical behavior of particulate electrodes, 15:49107 (RA;US)
Work in progress, 15:49109 (RA;US)

ZIRCALOY
See also ALLOY-ZR98SN-4
The MERLIN programme: Pt. 2, A description of the MERLIN rig, 15:48662 (R;GB)

ZIRCONIUM
See also ZIRCONIUM-ALPHA
Optical study and analysis of Pu^{4+} in single crystals of $ZrSiO_4$, 15:49020 (RA;US)
[Defects in close-packed metals and alloys]: Foreign trip report, August 9, 1990–August 22, 1990, 15:48896 (R;US)

ZIRCONIUM ALLOYS
An apparatus for studies of hydrogen isotope exchange over metals using laser-Raman spectroscopy, 15:48998 (R;US)

ZIRCONIUM OXIDES
Simultaneous particulates, NO_x, SO_x removal from flue gas by all solid-state electrochemical technology: Technical progress report No. 8, April 1, 1989–June 30, 1989, 15:48510 (R;US)
Theory of ceramic/zirconia composites: Toughening, strengthening, and synergism, 15:48904 (R;US)

ZIRCONIUM-ALPHA
Application of ion beam sputtering for diffusion study in solids, 15:50065 (R;GB)

Contract Number Index

Numbers assigned to DOE contracts announced in documents in this publication are listed. Contract numbers are sorted alphanumerically and list the primary corporate author of the document cited, the citation number, and the report number or other document identification.

Contract No.	Abstract No.	Report No.
AC01-87CE40762	**Solar Energy Research Inst., Golden, CO (USA)**	
	15:48806	DOE/CH/10093–78
AC01-88ER75425	**National Research Council, Washington, DC (USA). Committee on Nuclear Engineering Education**	
	15:48835	DOE/ER/75425–T1
AC02-76CH00016	**Brookhaven National Lab., Upton, NY (USA)**	
	15:48638	BNL-NUREG–44847
	15:48857	BNL–43758
	15:49225	BNL–43923
	15:49230	BNL–45013
	15:49239	BNL–44625
	15:49275	BNL–43928
	15:49276	BNL–45116
	15:49283	BNL–52244
	15:49918	BNL–45004
	15:49978	BNL–44911
	15:50018	BNL–45008
	15:50019	BNL–45009
	15:50020	BNL–45010
	15:50021	BNL–45011
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research	
	15:48664	NUREG/CR–5254
	15:48940	CONF-900143–
	15:49346	CONF-900143–
	15:49372	CONF-900143–
AC02-76CH03000	**Fermi National Accelerator Lab., Batavia, IL (USA)**	
	15:49250	FNAL-TM–1674
	15:49251	FNAL-TM–1676
	15:49252	FNAL-TM–1678
	15:50216	FNAL-TM–1679
AC02-76ER01338		
	15:49650	Published article
AC02-83CH10093	**Solar Energy Research Inst., Golden, CO (USA)**	
	15:48461	SERI/CP–211-3976
	15:48471	SERI/TP–253-3616
	15:48483	SERI/TP–257-3795
	15:48484	SERI/TP–257-3939
	15:48833	SERI/TP–231-3622
	15:48462	SERI/TP–211-3906
	15:48463	SERI/TP–211-3908
	15:48464	SERI/TP–211-3918
	15:48806	DOE/CH/10093–78
AC03-76SF00098	**Lawrence Berkeley Lab., CA (USA)**	
	15:48751	LBL–22702
	15:48783	LBL–28197
	15:48784	LBL–28268
	15:48932	LBL–27358
	15:49236	LBL–28189
	15:50001	LBL–29361
	15:48686	CONF-900143–
	15:49270	CONF-900143–
	15:49271	CONF-900143–
	15:49273	CONF-900143–
	15:49322	CONF-900143–
	15:49324	CONF-900143–
	15:49330	CONF-900143–
	15:49332	CONF-900143–
	15:49333	CONF-900143–
	15:49338	CONF-900143–
	15:49339	CONF-900143–
	15:49341	CONF-900143–
	15:49342	CONF-900143–
	15:49356	CONF-900143–
	15:49360	CONF-900143–
	15:49368	CONF-900143–
	15:49370	CONF-900143–
	15:49702	CONF-900143–
	15:50246	CONF-900143–
	15:48984	Published article
AC03-76SF00515		
	15:49268	CONF-900143–
	15:49272	CONF-900143–
	15:49334	CONF-900143–
	15:49359	CONF-900143–
	15:49271	CONF-900143–
AC03-87DP10560	**KMS Fusion, Inc., Ann Arbor, MI (USA)**	
	15:50169	DOE/DP/10560–7
AC03-89SF17885	**General Atomics, San Diego, CA (USA)**	
	15:48573	GA-A–20115
AC04-76DP00613	**Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div.**	
	15:49209	KCP–613-4404
	15:50222	KCP–613-4118
AC04-76DP00789	**Sandia National Labs., Albuquerque, NM (USA)**	
	15:48288	SAND–90-1031C
	15:48394	SAND–90-0494
	15:48460	SAND–90-2272C
	15:48468	SAND–90-0390
	15:48470	SAND–90-0097C
	15:48478	SAND–90-0325C
	15:48479	SAND–90-1696C
	15:48726	SAND–90-1008C
	15:48897	SAND–90-2108C
	15:48973	SAND–90-0881C
	15:48974	SAND–90-1718C
	15:48975	SAND–90-1755C
	15:48976	SAND–90-1756C
	15:48977	SAND–90-2153C
	15:48978	SAND–90-2191C
	15:48979	SAND–90-2282C
	15:49083	SAND–2302C
	15:49164	SAND–90-1200-C-Extd.Abst.
	15:49165	SAND–90-1248C
	15:49166	SAND–90-2053C
	15:49190	SAND–90-1323C
	15:49191	SAND–2033C
	15:49217	SAND–90-0650C
	15:49218	SAND–90-0688C
	15:49367	SAND–90-2173C

Contract No.	Abstract No.	Report No.
	15:49379	SAND–90-1747C
	15:49393	SAND–90-1250
	15:49406	SAND–89-0423
	15:49742	SAND–90-1126C
	15:49892	SAND–90-1676C
	15:49893	SAND–90-2317C
	15:50202	SAND–90-1346C
	15:50240	SAND–90-1729C
	15:50241	SAND–90-2034C
	Lawrence Livermore National Lab., CA (USA)	
	15:49167	UCRL–101932-Rev.1
	15:49357	CONF-900143–
	15:50248	CONF-900143–
	15:48943	Published article
AC04-86AL31950	**Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.**	
	15:48260	DOE/AL/31950–T3
AC04-88DP43495	**Los Alamos National Lab., NM (USA)**	
	15:48408	LA-UR–90-2164
	EG and G Mound Applied Technologies, Miamisburg, OH (USA)	
	15:50235	MLM–3656(OP)
AC05-76OR00033	**Massachusetts Inst. of Tech., Cambridge, MA (USA)**	
	15:48232	DOE/OR/00033–T441
	Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Nuclear Engineering	
	15:48593	DOE/OR/00033–T440
	Oak Ridge Associated Universities, Inc., TN (USA)	
	15:48647	DOE/OR/00033–T442
	Wisconsin Univ., Madison, WI (USA)	
	15:50120	DOE/OR/00033–T445
	Yale Univ., New Haven, CT (USA)	
	15:49568	DOE/OR/00033–T439
	Pennsylvania State Univ., University Park, PA (USA). Graduate School	
	15:49896	DOE/OR/00033–T444
AC05-84OR21400	**International Atomic Energy Agency, Vienna (Austria)**	
	15:50132	IAEA-CN–53/C-4-7
	Oak Ridge National Lab., TN (USA)	
	15:48224	CONF-901101–33
	15:48229	CONF-901101–9
	15:48230	CONF-901101–10
	15:48231	CONF-901101–27
	15:48403	CONF-901101–18
	15:48404	CONF-901101–20
	15:48407	ORNL/FTR–3716
	15:48526	CONF-901101–11
	15:48527	CONF-901101–12
	15:48578	ORNL/FTR–3725
	15:48579	CONF-901101–32
	15:48580	CONF-901109–12
	15:48600	CONF-901178–1
	15:48611	CONF-901101–29
	15:48612	CONF-901199–10
	15:48642	CONF-901101–19
	15:48645	CONF-901109–1
	15:48646	CONF-9010185–1
	15:48668	ORNL/FTR–3737
	15:48699	CONF-9004177–3
	15:48771	CONF-901097–1
	15:48772	CONF-901194–1
	15:48773	CONF-901194–2
	15:48805	CONF-901109–14
	15:48864	CONF-900936–6
	15:48867	CONF-901105–3
	15:48896	ORNL/FTR–3721
	15:48912	CONF-900731–2
	15:48933	ORNL/FTR–3713
	15:48950	CONF-900936–2
	15:48951	CONF-900936–5
	15:48952	CONF-901105–11
	15:48953	CONF-901177–1
	15:48992	CONF-9009174–1
	15:49082	ORNL/FTR–3741
	15:49160	CONF-901101–8
	15:49161	CONF-901109–18
	15:49163	ORNL/FTR–3731
	15:49187	CONF-900757–5
	15:49206	CONF-9009174–2
	15:49316	ORNL/FTR–3730
	15:49377	CONF-9007167–1
	15:49391	ORNL/M–1250
	15:49405	CONF-901104–1
	15:49412	ORNL/FTR–3742
	15:49574	ORNL/FTR–3739
	15:49575	ORNL/RASA–89/10
	15:49589	CONF-9009164–2
	15:49642	CONF-9009243–1
	15:49645	ORNL/FTR–3729
	15:49870	CONF-900964–2
	15:49871	CONF-9009174–3
	15:49872	CONF-9009174–4
	15:49917	ORNL/FTR–3732
	15:50053	CONF-901121–6
	15:50063	CONF-901067–1
	15:50068	CONF-900914–1
	15:50069	CONF-900936–4
	15:50089	ORNL/FTR–3724
	15:50112	CONF-901025–6
	15:50168	CONF-901007–2
	15:50213	CONF-901101–24
	15:50214	CONF-901150–1
	15:50237	ORNL/TM–11637
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering	
	15:48571	NUREG/CR–5554
	15:48608	NUREG/CR–5451
	Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data	
	15:48592	NUREG/CR–2000-Vol.9-No.8
	15:48617	CONF-900143–
	15:48671	CONF-900143–
	15:49222	CONF-900143–
	15:49364	CONF-900143–
	15:49561	CONF-900143–
	15:49564	CONF-900143–
	15:48941	Published article
	15:48944	Published article
AC05-84OS21400	**Oak Ridge Y-12 Plant, TN (USA)**	
	15:49169	Y/DX–943
	15:49386	Y/IB–20
AC05-84OT21400	**Oak Ridge Gaseous Diffusion Plant, TN (USA)**	
	15:48216	K/ETO–34
	15:48883	K/CSD/INF–89/42/R1
AC06-76RL01830	**General Electric Co., Richland, WA (USA). Hanford Atomic Products Operation**	
	15:48225	HW–72042
	Electric Power Research Inst., Palo Alto, CA (USA)	
	15:48233	EPRI-NP–6940
	Pacific Northwest Lab., Richland, WA (USA)	
	15:48287	PNL-SA–17566
	15:48442	PNL-SA–17279
	15:48496	PNL–7403
	15:48497	PNL-SA–18353

Contract No.	Abstract No.	Report No.
	15:48690	PNL–7441
	15:48794	PNL–7449
	15:48795	PNL-SA–18436
	15:48825	PNL-SA–17985
	15:48972	PNL-SA–17678
	15:48987	PNL-SA–18212
	15:49025	PNL-SA–18081
	15:49151	PNL–7145
	15:49546	PNL–6450-34-HEDR
	15:49547	PNL–7201
	15:49548	PNL–7216-Vol.1
	15:49583	PNL–7216-Vol.2
	15:49584	PNL–7435
	15:49640	PNL-SA–17865
	15:49730	PNL-SA–18290
	15:49741	PNL–5895
	15:50239	PNL-SA–18095
	15:50255	PNL-SA–17925
	15:48793	PNL–7397
	15:49354	CONF-900143–
	15:49355	CONF-900143–
AC06-87RL10930	**Westinghouse Hanford Co., Richland, WA (USA)**	
	15:48292	WHC-EP–0063-1
	15:48293	WHC-EP–0275-Rev.2
	15:48669	WHC-SA–0821
	15:49557	WHC-SA–0483
	USDOE Richland Operations Office, WA (USA)	
	15:48263	DOE/RL–90-17
	15:48618	DOE/RL–90-34
AC07-76ID01570	**EG and G Idaho, Inc., Idaho Falls, ID (USA)**	
	15:48572	EGG-M–90249
	15:48870	EGG-M–90064
	15:49154	EGG-M–90041
	15:49180	EGG-M–90067
	15:48839	DOE/ID–10287
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution	
	15:48667	NUREG/CR–5575
	15:48670	CONF-900143–
AC08-85NV10384	**Nevada Univ., Reno, NV (USA). Water Resources Center**	
	15:49592	DOE/NV/10384–25
AC09-76SR00001		
	15:49175	CONF-900143–
AC12-76SN00052	**Knolls Atomic Power Lab., Schenectady, NY (USA)**	
	15:48658	KAPL–4718
AC21-86MC23077	**Foster Wheeler USA Corp., Clinton, NJ (USA)**	
	15:48489	DOE/MC/23077–2866
AC21-87MC23270	**International Fuel Cells Corp., South Windsor, CT (USA)**	
	15:48490	DOE/MC/23270–2876
AC22-84PC70507	**Montana State Univ., Bozeman, MT (USA). Dept. of Mechanical Engineering**	
	15:48757	DOE/PC/70507–T3
AC22-85PC80016	**SRI International, Menlo Park, CA (USA)**	
	15:48075	DOE/PC/80016–T9
AC22-86PC90014	**UOP, Inc., Des Plaines, IL (USA)**	
	15:48078	DOE/PC/90014–T7
AC22-86PC91257	**TRW Space and Technology Group, Redondo Beach, CA (USA). Applied Technology Div.**	
	15:48079	DOE/PC/91257–T6
AC22-87PC79855	**Helipump Corp., Cleveland, OH (USA)**	
	15:48510	DOE/PC/79855–T8
	15:48511	DOE/PC/79855–T9
	15:48503	DOE/PC/79855–T1
	15:48504	DOE/PC/79855–T2
	15:48505	DOE/PC/79855–T3
	15:48506	DOE/PC/79855–T4
	15:48507	DOE/PC/79855–T5
	15:48508	DOE/PC/79855–T6
	15:48509	DOE/PC/79855–T7
AC22-87PC90274	**TRW, Inc., Redondo Beach, CA (USA). Applied Technology Div.**	
	15:48758	DOE/PC/90274–T8
AC22-88PC88800	**Consolidation Coal Co., Library, PA (USA). Research and Development Dept.**	
	15:48076	DOE/PC/88800–26
AC22-88PC88802	**SRI International, Menlo Park, CA (USA)**	
	15:48077	DOE/PC/88802–T5
AC22-88PC88951	**Institute of Gas Technology, Chicago, IL (USA)**	
	15:48210	DOE/PC/88951–5
	15:48211	DOE/PC/88951–6
AC22-89PC88889	**MK-Ferguson Co., Cleveland, OH (USA)**	
	15:48512	DOE/PC/88889–T5
AC22-89PC89909	**Virginia Center for Coal and Minerals Processing, Blacksburg, VA (USA)**	
	15:48072	DOE/PC/89909–T1
AC34-90DP62349	**EG and G Rocky Flats, Inc., Golden, CO (USA)**	
	15:48393	RFP–4433
	EG and G Rocky Flats, Inc., Golden, CO (USA). Rocky Flats Plant	
	15:50104	RFP–4418
AM03-76SF00010		
	15:49272	CONF-900143–
AS05-77ER05490	**Louisiana State Univ., Baton Rouge, LA (USA)**	
	15:49905	CONF-900822–9
	Louisiana State Univ., Baton Rouge, LA (USA). Dept. of Physics and Astronomy	
	15:49924	DOE/ER/05490–112
AT04-85AL33408	**National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center**	
	15:48469	DOE/NASA/33408–4
FC07-88ID12772	**EG and G Idaho, Inc., Idaho Falls, ID (USA)**	
	15:49180	EGG-M–90067
FC21-86MC11076	**Western Research Inst., Laramie, WY (USA)**	
	15:48202	DOE/MC/11076–2851
	15:48206	DOE/MC/11076–2834
FC21-87MC24207	**West Virginia Univ., Morgantown, WV (USA). Dept. of Chemical Engineering**	
	15:48108	DOE/MC/24207–2857
	West Virginia Univ., Morgantown, WV (USA). Dept. of Mechanical and Aerospace Engineering	
	15:48109	DOE/MC/24207–2858
FC22-87PC79798	**Babcock and Wilcox Co., Barberton, OH (USA)**	
	15:48502	DOE/PC/79798–T7
FC22-89PC88750	**TRW, Inc., Redondo Beach, CA (USA)**	
	15:48486	CONF-9004133–6
FC22-90PC89651	**Southern Co. Services, Inc., Birmingham, AL (USA)**	
	15:48513	DOE/PC/89651–T1
FG02-85ER40231	**Syracuse Univ., NY (USA)**	
	15:49899	DOE/ER/40231–T8
FG02-85ER53198	**Wisconsin Univ., Madison, WI (USA). Plasma Physics Research**	
	15:50115	DOE/ER/53198–160
FG02-86ER13491	**Kansas State Univ., Manhattan, KS (USA)**	
	15:49873	DOE/ER/13491–450

Contract No.	Abstract No.	Report No.
FG02-86ER52127	Illinois Univ., Urbana, IL (USA). Dept. of Nuclear Engineering	
	15:50114	DOE/ER/52127–72
FG02-86ER53240	Yale Univ., New Haven, CT (USA)	
	15:50116	DOE/ER/53240–3
FG02-86ER60408	Chicago Univ., IL (USA)	
	15:49655	DOE/ER/60408–2
FG02-86ER60418	Franklin McLean Memorial Research Inst., Chicago, IL (USA)	
	15:49687	DOE/ER/60418–2
FG02-86ER60438	Franklin McLean Memorial Research Inst., Chicago, IL (USA)	
	15:49688	DOE/ER/60438–2
FG02-87ER13808	Northwestern Univ., Chicago, IL (USA)	
	15:49124	DOE/ER/13808–T1
FG02-87ER45328	Cornell Univ., Ithaca, NY (USA)	
	15:48869	DOE/ER/45328–4
FG02-88CE90025	Michigan Univ., Ann Arbor, MI (USA). Dept. of Mechanical Engineering and Applied Mechanics	
	15:48836	DOE/CE/90025–2
FG02-88ER13968	Wisconsin Univ., Madison, WI (USA). Dept. of Horticulture	
	15:49643	DOE/ER/13968–T2
FG02-88ER40417	Brookhaven National Lab., Upton, NY (USA)	
	15:50021	BNL–45011
FG02-88ER45370	Wisconsin Univ., Madison, WI (USA)	
	15:48954	DOE/ER/45370–3
FG02-88ER60682	National Research Council of Canada, Ottawa, ON (Canada)	
	15:49653	CONF-8808142–Pt.1
	15:49654	CONF-8808142–Pt.2
FG02-89CE90029	Clarkson Univ., Potsdam, NY (USA)	
	15:49179	DOE/CE/90029–3
FG02-89ER53297	Columbia Univ., New York, NY (USA). Dept. of Applied Physics and Nuclear Engineering	
	15:50117	DOE/ER/53297–2
FG02-89ER60888	Canada Mortgage and Housing Corp., Ottawa, ON (Canada)	
	15:48774	DOE/ER/60888–1-Vol.1
	15:48775	DOE/ER/60888–1-Vol.2
	15:48776	DOE/ER/60888–1-Vol.3
	15:48777	DOE/ER/60888–1-Vol.4
	15:48778	DOE/ER/60888–1-Vol.5
FG03-86ER13600	Physical Optics Corp., Torrance, CA (USA)	
	15:49153	DOE/ER/13600–T4
FG03-86SF16306	Colorado State Univ., Fort Collins, CO (USA). Solar Energy Applications Lab.	
	15:48472	DOE/SF/16306–23
FG05-80ET53088	Texas Univ., Austin, TX (USA)	
	15:49749	DOE/ET/53088–452
	Texas Univ., Austin, TX (USA). Inst. for Fusion Studies	
	15:49748	DOE/ET/53088–450
	15:50118	DOE/ET/53088–447
	15:50119	DOE/ET/53088–451
FG05-87ER40319	Florida State Univ., Tallahassee, FL (USA)	
	15:49907	FSU-HEP–881011
	Florida State Univ., Tallahassee, FL (USA). Dept. of Physics	
	15:49293	FSU-HEP–041090
	15:49900	DOE/ER/40319–3
	Illinois Univ., Urbana, IL (USA)	
	15:49286	CONF-9003159–2
	Florida State Univ., Tallahassee, FL (USA). High Energy Physics Lab.	
	15:49908	FSU-HEP–890130
FG05-88ER13846	Maryland Univ., College Park, MD (USA). Dept. of Electrical Engineering	
	15:50091	DOE/ER/13846–3
FG05-88ER13958	Toledo Univ., OH (USA). Dept. of Physics and Astronomy	
	15:49874	DOE/ER/13958–16
FG05-90ER60954	American Meteorological Society, Boston, MA (USA)	
	15:49458	DOE/ER/60954–1
FG06-89ER14057	Oregon State Univ., Corvallis, OR (USA). Coll. of Oceanography	
	15:49732	DOE/ER/14057–1
FG06-89ER14064	Washington Univ., Seattle, WA (USA)	
	15:49733	DOE/ER/14064–1
FG22-86PC90505	Arizona Univ., Tucson, AZ (USA). Dept. of Chemical Engineering	
	15:48112	DOE/PC/90505–T5
	15:48113	DOE/PC/90505–T6
FG22-86PC90514	Illinois Univ., Urbana, IL (USA). Dept. of Civil Engineering	
	15:48093	DOE/PC/90514–T10
FG22-87PC79919	Columbia Univ., New York, NY (USA). Henry Krumb School of Mines	
	15:48083	DOE/PC/79919–13
FG22-87PC79925	Lehigh Univ., Bethlehem, PA (USA). Dept. of Chemistry	
	15:48084	DOE/PC/79925–7
	15:48085	DOE/PC/79925–11
FG22-88PC88923	Iowa State Univ. of Science and Technology, Ames, IA (USA). Dept. of Chemistry	
	15:48086	DOE/PC/88923–T2
FG22-89PC89769	Illinois Inst. of Tech., Chicago, IL (USA). Dept. of Chemical Engineering	
	15:48111	DOE/PC/89769–T2
W-31-109-ENG-38	Argonne National Lab., IL (USA)	
	15:49980	CONF-900814–13
	15:49320	CONF-900143–
	15:49352	CONF-900143–
W-31109-ENG-38	Argonne National Lab., Idaho Falls, ID (USA)	
	15:48388	CONF-9007106–72
	15:48402	CONF-900873–3
	15:48620	CONF-900873–2
	Argonne National Lab., IL (USA)	
	15:48071	CONF-900631–3
	15:48091	CONF-900631–4
	15:48097	CONF-900801–29
	15:48105	CONF-900546–14
	15:48106	CONF-900801–33
	15:48107	CONF-9006105–12
	15:48217	CONF-900623–17
	15:48218	CONF-9009256–1
	15:48257	CONF-900579–2
	15:48258	CONF-900694–1
	15:48259	CONF-9006270–1
	15:48485	CONF-900628–3
	15:48499	CONF-900801–32
	15:48500	CONF-9007170–1
	15:48581	CONF-9009255–1
	15:48609	CONF-9009108–1
	15:48640	CONF-900804–32
	15:48641	CONF-901101–17
	15:48643	CONF-901101–30
	15:48644	CONF-901101–31
	15:48729	ANL–89/29
	15:48838	CONF-9006243–3
	15:48860	CONF-900466–85
	15:48861	CONF-900577–2
	15:48862	CONF-900623–18
	15:48863	CONF-900936–3
	15:48865	CONF-900975–1

Contract No.	Abstract No.	Report No.
	15:48866	CONF-901073–7
	15:48868	CONF-9005270–1
	15:48910	CONF-891119–140
	15:48911	CONF-900577–3
	15:48913	CONF-900813–1
	15:48914	CONF-900819–1
	15:48915	CONF-900830–2
	15:48916	CONF-901109–4
	15:48949	CONF-900562–8
	15:49033	CONF-900802–10
	15:49177	CONF-901109–8
	15:49205	CONF-900944–2
	15:49240	CONF-9009123–2
	15:49241	CONF-9009123–3
	15:49277	CONF-900601–9
	15:49285	CONF-901121–4
	15:49456	CONF-900534–4
	15:49457	CONF-900676–14
	15:49566	CONF-9009251–1
	15:49567	CONF-9010191–1
	15:49869	CONF-900802–7
	15:49979	CONF-900601–8
	15:50011	CONF-900450–11
	15:50022	CONF-901057–1
	15:50023	CONF-9004209–7
	15:50024	CONF-9007141–3
	15:50052	CONF-900970–3
	15:50167	CONF-900623–19
	15:50212	ANL/TM–423-Rev.2
	15:50215	CONF-9002131–3
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering	
	15:48537	NUREG/CP–0112-Vol.1
	15:48538	NUREG/CP–0112-Vol.2
	Argonne National Lab., IL (USA). Advanced Photon Source Div.	
	15:49224	ANL/APS-CP–3
	15:49565	ANL/APS/TM–7
	Argonne National Lab., IL (USA). Environmental Assessment and Information Sciences Div.	
	15:48255	ANL/EAIS/TM–24
W-7405-ENG-36	**Los Alamos National Lab., NM (USA)**	
	15:48284	LA–11671-MS
	15:48408	LA-UR–90-2164
	15:48577	LA-UR–90-1641
	15:48659	LA-UR–90-1833
	15:48660	LA-UR–90-2777
	15:48886	LA–11895-MS
	15:48887	LA-UR–90-2828
	15:48998	LA–11884-MS
	15:49385	LA-UR–90-2308
	15:49392	LA–11907-MS
	15:49644	LA-UR–90-2856
	15:49651	LA-UR–90-1548
	15:49704	LA-UR–90-2562
	15:49739	LA–11849-MS
	15:49740	LA-UR–90-2571
	15:49817	LA–11882-MS
	15:49993	LA-UR–90-2055
	15:49994	LA-UR–90-2212
	15:50000	LA-UR–90-3255
	15:50060	LA-UR–90-2514
	15:50084	LA–11915-MS
	15:50103	LA-UR–90-1845
	15:50224	LA-UR–90-2564
	15:50225	LA-UR–90-2577
	15:50254	LA-UR–90-2637
	15:50246	CONF-900143–
W-7405-ENG-48	**Los Alamos National Lab., NM (USA)**	
	15:49898	LA-UR–90-2638
	Lawrence Livermore National Lab., CA (USA)	
	15:48291	UCRL-JC–104547
	15:48373	UCRL-ID–104196
	15:48395	UCRL-JC–104361
	15:48851	UCRL-JC–104359
	15:48898	UCRL-JC–104721
	15:49167	UCRL–101932-Rev.1
	15:49168	UCRL–102264
	15:49220	UCRL-JC–103328
	15:49237	UCRL-JC–103797
	15:49238	UCRL-JC–103825
	15:49266	UCRL-JC–103783
	15:49318	UCRL-JC–103762
	15:49380	UCRL–98005
	15:49381	UCRL–102842
	15:49382	UCRL–102843
	15:49394	UCRL–102942
	15:49395	UCRL-JC–104276
	15:49400	UCRL-ID–104759
	15:49652	UCRL–102523-Rev.1
	15:49731	UCRL-ID–104571
	15:49743	UCRL-JC–104272
	15:49836	UCRL-JC–104223-Rev.1
	15:49895	UCRL-JC–104665
	15:50088	UCRL-JC–103948
	15:50242	UCRL–102263-Rev.2
	15:50243	UCRL-JC–103573
	15:50244	UCRL-JC–104493
	15:48701	UCRL-CR–104383
	15:49219	UCRL-CR–104589
	15:49327	CONF-900143–
	15:49375	CONF-900143–
W-7405-ENG-82	**Ames Lab., IA (USA)**	
	15:48087	IS–5009
	15:48089	IS-M–649
	15:48094	IS-M–625
	15:48104	IS-M–644
	15:48116	IS-M–650
	15:48654	IS-M–619
	15:48876	IS–4992
	15:48877	IS-M–623
	15:48878	IS-M–637
	15:48879	IS-M–638
	15:48880	IS-M–646
	15:48881	IS-T–1474
	15:48918	IS-M–630
	15:48919	IS-M–631
	15:48921	IS-M–633
	15:48922	IS-M–641
	15:48923	IS-M–642
	15:48924	IS-T–1489
	15:48956	IS-M–635
	15:48957	IS-M–645
	15:48995	IS-M–618
	15:49034	IS-M–620
	15:49912	IS-T–1488
	15:50075	IS-M–639
	15:50076	IS-M–640
	15:50097	IS-M–643
	Iowa State Univ. of Science and Technology, Ames, IA (USA)	
	15:48088	IS-M–629
	15:48095	IS-M–628
	15:48920	IS-M–632
	15:48996	IS-M–636
	15:49189	IS-M–627
	15:49738	IS-IPRT–6
	15:50074	IS-M–634

Contract No.	Abstract No.	Report No.
Iowa State Univ. of Science and Technology, Ames, IA (USA). Engineering Research Inst.		
	15:48114	IS-M–647
	15:48115	IS-M–648
Iowa State Univ. of Science and Technology, Ames, IA (USA). Iowa State Mining and Mineral Resources Research Inst.		
	15:49737	IS-IPRT–5
	15:49281	CONF-900143–

Report Number Index

The report number index consists of the alphanumeric identifiers assigned to report literature as well as patent and conference literature cited in this publication. Entries provide the abstract number; the source(s) of availability of the document; the GPO file prefix for GPO depository library documents; the order number for OSTI and NTIS report ordering purposes; and, if the document was distributed under the DOE distribution program, the category number is shown for paper copy (PC), microfiche (MF), or no distribution (ND). These categories are included to assist DOE librarians in responding to requests for reports in their collections. The index also lists secondary numbers, with the corresponding abstract numbers and cross-references to other identifying numbers.

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
AD-A–					
221936/8/XAB	15:48901	NTIS, PC A03/MF A01			
221955/8/XAB	15:49415	NTIS, PC A06/MF A01			
222186/9/XAB	15:49402	NTIS, PC A03/MF A01			
222246/1/XAB	15:49407	NTIS, PC A03/MF A01			
222466/5/XAB	15:50209	NTIS, PC A03/MF A01			
222554/8/XAB	15:49850	NTIS, PC A02/MF A01			
222574/6/XAB	15:49851	NTIS, PC A06/MF A01			
222580/3/XAB	15:49852	NTIS, PC A03/MF A01			
222596/9/XAB	15:49408	NTIS, PC A04/MF A01			
222603/3/XAB	15:49030	NTIS, PC A03/MF A01			
222605/8/XAB	15:49031	NTIS, PC A03/MF A01			
222607/4/XAB	15:49200	NTIS, PC A03/MF A01			
222609/0/XAB	15:49853	NTIS, PC A04/MF A01			
222611/6/XAB	15:49641	NTIS, PC A02/MF A01			
222612/4/XAB	15:49854	NTIS, PC A06/MF A01			
222635/5/XAB	15:48902	NTIS, PC A05/MF A01			
222636/3/XAB	15:49201	NTIS, PC A04/MF A01			
222642/1/XAB	15:49404	NTIS, PC A07/MF A01			
222647/0/XAB	15:49706	NTIS, PC A03/MF A01			
222692/6/XAB	15:48846	NTIS, PC A11/MF A02			
222717/1/XAB	15:48454	NTIS, PC A01/MF A01			
222719/7/XAB	15:50108	NTIS, PC A02/MF A01			
222720/5/XAB	15:49202	NTIS, PC A01/MF A01			
222722/1/XAB	15:49707	NTIS, PC A03/MF A01			
222753/6/XAB	15:49416	NTIS, PC A06/MF A01			
222754/4/XAB	15:49417	NTIS, PC A05/MF A01			
222798/1/XAB	15:50210	NTIS, PC A03/MF A01			
222809/6/XAB	15:49409	NTIS, PC A03/MF A01			
222815/3/XAB	15:48735	NTIS, PC A13/MF A02			
222838/5/XAB	15:49656	NTIS, PC A02/MF A01			
222850/0/XAB	15:49389	NTIS, PC A03/MF A01			
222853/4/XAB	15:48903	NTIS, PC A04/MF A01			
222861/7/XAB	15:49855	NTIS, PC A03/MF A01			
222880/7/XAB	15:49708	NTIS, PC A07/MF A01			
222882/3/XAB	15:48948	NTIS, PC A05/MF A01			
222891/4/XAB	15:48854	NTIS, PC A02/MF A01			
222910/2/XAB	15:48124	NTIS, PC A99/MF E06			
222911/0/XAB	15:48850	NTIS, PC A03/MF A01			
222931/8/XAB	15:48904	NTIS, PC A03/MF A01			
222944/1/XAB	15:49856	NTIS, PC A02/MF A01			
222951/6/XAB	15:48855	NTIS, PC A06/MF A01			
222952/4/XAB	15:49159	NTIS, PC A05/MF A01			
222960/7/XAB	15:48856	NTIS, PC A03/MF A01			
222972/2/XAB	15:49390	NTIS, PC A03/MF A01			
223012/6/XAB	15:48905	NTIS, PC A03/MF A01			
223031/6/XAB	15:48906	NTIS, PC A02/MF A01			
223036/5/XAB	15:49203	NTIS, PC A02/MF A01			
223046/4/XAB	15:48148	NTIS, PC A03/MF A01			
223047/2/XAB	15:49223	NTIS, PC A06/MF A01			
223068/8/XAB	15:48759	NTIS, PC A02/MF A01			
223070/4/XAB	15:48988	NTIS, PC A03/MF A01			
223072/0/XAB	15:50211	NTIS, PC A10/MF A02			
223073/8/XAB	15:49410	NTIS, PC A03/MF A01			
223075/3/XAB	15:49204	NTIS, PC A03/MF A01			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
223080/3/XAB	15:49411	NTIS, PC A03/MF A01			
223097/7/XAB	15:48691	NTIS, PC A03/MF A01			
223108/2/XAB	15:49396	NTIS, PC A04/MF A01			
223136/3/XAB	15:49587	NTIS, PC A14/MF A02			
223148/8/XAB	15:49403	NTIS, PC A07/MF A01			
223198/3/XAB	15:49857	NTIS, PC A03/MF A01			
223215/5/XAB	15:48849	NTIS, PC A03/MF A01			
223229/6/XAB	15:49858	NTIS, PC A03/MF A01			
955922/0/XAB	15:49709	NTIS, PC A03/MF A01			
AD-P–					
005939/4/XAB	15:48907	NTIS, PC A03/MF A01			
005940/2/XAB	15:48908	NTIS, PC A03/MF A01			
AERE-R–					
12810	15:49710	Available from H.M. Stationery Office, London, price Pound 10.00			
AFIT/CI/CIA–					
90-028	15:48735	*See* AD-A–222815/3/XAB			
90-14D	15:48846	*See* AD-A–222692/6/XAB			
AFIT/GA/ENY–					
90J-02	15:49159	*See* AD-A–222952/4/XAB			
AFME–					
82-066-2	15:48476	NTIS (US Sales Only), PC A14/MF A01		DE91701156	
82-066-7	15:48455	NTIS (US Sales Only), PC A99/MF A01		DE91701155	
83-2434	15:48456	NTIS (US Sales Only), PC A03/MF A01		DE91701147	
84-1724-4	15:48480	NTIS (US Sales Only), PC A03/MF A01		DE91701172	
84-1724-6	15:48481	NTIS (US Sales Only), PC A05/MF A01		DE91701170	
84.2242	15:48477	NTIS (US Sales Only), PC A20/MF A01		DE91701157	
85-05-1061	15:48466	NTIS (US Sales Only), PC A05/MF A01		DE91701150	
85-06-1096	15:48457	NTIS (US Sales Only), PC A04/MF A01		DE91701149	
85-09-1106-3	15:48458	NTIS (US Sales Only), PC A03/MF A01		DE91701154	
85-91-1002-2	15:48476	*See* AFME–82-066-2			
85-91-1002-7	15:48455	*See* AFME–82-066-7			
85-91-1003-1	15:48482	NTIS (US Sales Only), PC A05/MF A01		DE91701171	
86-04-0038	15:48767	NTIS (US Sales Only), PC A06/MF A01		DE91701158	
86-91-0001	15:48768	NTIS (US Sales Only), PC A03/MF A01		DE91701152	
AIAA–					
90-2240	15:49193	*See* N–90-24349			
90-2319	15:49156	*See* N–90-23518			
90-2452	15:49192	*See* N–90-23591			
ANL–					
89/29	15:48729	NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90018032	PC-500
90/22-Vol.1	15:48537	*See* NUREG/CP–0112-Vol.1			
90/22-Vol.2	15:48538	*See* NUREG/CP–0112-Vol.2			
ANL/APS-CP–					
3	15:49224	NTIS, PC A13/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90018030	PC-411
ANL/APS/TM–					
7	15:49565	NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90018002	MF-411
ANL/EAIS/TM–					
24	15:48255	NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90018004	MF-800
ANL/TM–					
423-Rev.2	15:50212	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018020	MF-405
ANS-R–					
598-2	15:49711	Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ			
678-1	15:48256	Available from A.N.S., Eastleigh House, 60, East St., Epsom, Surrey KT17 1HB, price Pound 15.00			
ANSTO/E–					
688	15:48372	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601974	
APC-SB–					
318	15:48637	Available from Angewandte Physik Consulting GmbH (APC), Stuttgart (Germany, F.R.)			
ARC–					
90-02879	15:49455	PC Alberta Legislature Library, 216 Legislature Bldg., Edmonton, AB, CAN T5K 2B6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
AVSCOM-TR–					
90-C-003	15:48969	*See* N–90-24382			
AWS/TR–					
80/003-REV	15:49415	*See* AD-A–221955/8/XAB			
BARC–					
1473	15:49147	NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS		DE91601427	
1479	15:50090	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600476	
1482	15:48222	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601488	
1483	15:50061	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601980	
1484	15:48989	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601345	
1486	15:48223	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601489	
1489	15:50109	NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS		DE91600853	
1492	15:50062	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601981	
BAW–					
2067-Vol.11	15:48665	*See* NUREG/CR–5395-Vol.11			
2099-Vol.11-Add.	15:48666	*See* NUREG/CR–5395-Vol.11-Add.			
BISI-EM-TRANS–					
196	15:48401	Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ			
BISI-NF-TRANS–					
234	15:50065	Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ			
BMI–					
2139-Vol.6	15:48663	*See* NUREG/CR–4624-Vol.6			
BNL–					
43758	15:48857	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90007150	MF-404
43923	15:49225	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017631	MF-414
43928	15:49275	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000120	
44625	15:49239	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000119	MF-414
44911	15:49978	NTIS, PC A22/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017639	MF-414
45004	15:49918	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000122	MF-414
45008	15:50018	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017634	MF-413
45009	15:50019	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017633	MF-413
45010	15:50020	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017635	MF-413
45011	15:50021	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017632	MF-413
45013	15:49230	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017636	MF-414
45116	15:49276	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017628	MF-414
52244	15:49283	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018029	PC-400
BNL-NUREG–					
44847	15:48638	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015125	
52168	15:48664	*See* NUREG/CR–5254			
BR–					
82(11.118)	15:49588	OSTI; US Fish and Wildlife Service, NASA-Slidell Computer Complex, 1010 Gause Blvd., Slidell, LA 70458		TI90017540	
BRL-TR–					
3096	15:49408	*See* AD-A–222596/9/XAB			
BWC–					
90-03956	15:48858	PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
CAA-TP–					
89-8	15:49404	*See* AD-A–222642/1/XAB			
CBPF-MO–					
001/89	15:48986	Available from the Library of the Comissao Nacional de Energia Nuclear, RJ, Brazil			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CBPF-NF–					
001/89	15:49746	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600982	
003/89	15:49962	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600515	
006/89	15:50067	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600635	
009/89	15:49919	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601097	
043/86	15:48909	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601676	
CDTN–					
432	15:48212	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601482	
CE–					
03116	15:48412	*See* FERIC–HB07			
03117	15:48443	*See* CSCE–CE03117			
03118	15:48192	*See* CU/FCE–CE03118			
03120	15:48769	*See* CEEA–827U675-Vol.1			
03121	15:48770	*See* CEEA–827U675-Vol.2			
03122	15:49473	*See* OH/RD–403G348			
03123	15:48187	*See* NEB-SS–22-1/1990-5E			
03124	15:48188	*See* NEB-SS–22-1/1990-5F			
03127	15:48186	*See* IL–90-9			
03128	15:48168	*See* D–90-3			
03129	15:48185	*See* D–90-7			
03130	15:48182	*See* D–89-11			
03131	15:48184	*See* D–89-9			
03132	15:48167	*See* D–89-10			
03133	15:48813	*See* OMAF/AE–89-01			
03134	15:48814	*See* OMAF/AE–89-02			
03135	15:48815	*See* OMAF/AE–89-03			
03136	15:48816	*See* OMAF/AE–89-04			
03137	15:48817	*See* OMAF/AE–89-05			
03138	15:48818	*See* OMAF/AE–89-06			
03140	15:49744	*See* WAU/CGS–CE03140			
03141	15:48133	*See* ST–89-17			
03142	15:48131	*See* ST–89-18			
03143	15:48754	*See* ST–88-28			
03144	15:48788	*See* OMAF/AE–88-07			
03145	15:48790	*See* OMAF/AE–89-08			
03146	15:48804	*See* CIPEC–CE03146			
03148	15:48204	*See* ST–88-43			
CEA-CONF–					
10024	15:49920	NTIS (US Sales Only), PC A03/MF A01		DE91700506	
10026	15:49921	NTIS (US Sales Only), PC A03/MF A01		DE91700485	
10028	15:49866	NTIS (US Sales Only), PC A02/MF A01		DE91700516	
10029	15:49867	NTIS (US Sales Only), PC A02/MF A01		DE91700515	
10032	15:48991	NTIS (US Sales Only), PC A03/MF A01		DE91700534	
10033	15:49747	NTIS (US Sales Only), PC A02/MF A01		DE91700508	
10037	15:49963	NTIS (US Sales Only), PC A03/MF A01		DE91700510	
10040	15:49904	NTIS (US Sales Only), PC A02/MF A01		DE91700504	
9407	15:48859	NTIS (US Sales Only), PC A02/MF A01		DE91700548	
9684	15:48687	NTIS (US Sales Only), PC A02/MF A01		DE91701160	
9880	15:48990	NTIS (US Sales Only), PC A03/MF A01		DE91700550	
9884	15:50110	NTIS (US Sales Only), PC A02/MF A01		DE91700544	
9885	15:50111	NTIS (US Sales Only), PC A02/MF A01		DE91700542	
9890	15:50166	NTIS (US Sales Only), PC A02/MF A01		DE91700540	
9955	15:50013	NTIS (US Sales Only), PC A02/MF A01		DE91702095	
9959	15:49903	NTIS (US Sales Only), PC A02/MF A01		DE91702096	
9976	15:50015	NTIS (US Sales Only), PC A02/MF A01		DE91702094	
CEA-DAS–					
617	15:48639	NTIS (US Sales Only), PC A03/MF A01		DE91700552	
666	15:48540	NTIS (US Sales Only), PC A03/MF A01		DE91702089	
668	15:48541	NTIS (US Sales Only), PC A03/MF A01		DE91702077	
669	15:48542	NTIS (US Sales Only), PC A03/MF A01		DE91702088	
672	15:48543	NTIS (US Sales Only), PC A02/MF A01		DE91700291	
CEA-DAS-STAS-SPI–					
1	15:48375	NTIS (US Sales Only), PC A03/MF A01		DE91700310	
CEA-N–					
2624	15:49922	NTIS (US Sales Only), PC A04/MF A01		DE91702073	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
2629	15:50007	NTIS (US Sales Only), PC A11/MF A01		DE91702081	
2640	15:49923	NTIS (US Sales Only), PC A03/MF A01		DE91700488	
CEA-R–					
5523	15:49284	NTIS (US Sales Only), PC A03/MF A01		DE91702163	
CEEA–					
827U675-Vol.1	15:48769	Canadian Electrical Association, One Westmount Square, Suite 500, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN			
827U675-Vol.2	15:48770	Canadian Electrical Association, One Westmount Square, Suite 500, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN			
CENBG–					
8937	15:50002	NTIS (US Sales Only), PC A02/MF A01		DE91702104	
8938	15:50003	NTIS (US Sales Only), PC A03/MF A01		DE91702103	
CERI–					
34	15:48139	PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
CFD–					
87/8	15:48176	Available from British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ			
CIPEC–					
CE03146	15:48804	Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST			
COESAM/PDFC–					
89/08	15:49587	*See* AD-A–223136/3/XAB			
CONF-8007153–		(4. Brazilian congress on chemical engineering; Belo Horizonte (Brazil); Jul 1980)			
	15:48212	*See* CDTN–432			
CONF-8703335–		(International seminar on particle emissions; Otaniemi (Finland); 11-12 Mar 1987)			
	15:49549	*See* PPP-JULK–9			
CONF-8705408–		(8. Canadian hydrotechnical conference; Montreal (Canada); 19-22 May 1987)			
	15:48443	*See* CSCE–CE03117			
CONF-870682–		(International workshop on novel mechanisms of superconductivity; Berkeley, CA (USA); 22-26 Jun 1987)			
7	15:48921	*See* IS-M–633			
CONF-8709426–		(1. European conference on thermoelectrics; Cardiff (UK); 15-17 Sep 1987)			
1	15:48956	*See* IS-M–635			
CONF-8710519–		(12. international symposium on coal ash utilization; Washington, DC (USA); 28-31 Oct 1987)			
1	15:48094	*See* IS-M–625			
CONF-880206–		(International conference on high temperature superconductors and materials and mechanisms of superconductivity; Interlaken (Switzerland); 29 Feb - 4 mar 1988)			
17	15:48920	*See* IS-M–632			
18	15:48918	*See* IS-M–630			
CONF-880384–		(DOD fiber-optics conference; McLean, VA (USA); 22-25 Mar 1988)			
2	15:49380	*See* UCRL–98005			
CONF-8804332–		(Absorption heat pumps workshop; London (UK); 12-14 Apr 1988)			
	15:48807	*See* EUR–11888			
CONF-880616–		(4. workshop on integrity of containments for nuclear power plants; Arlington, VA (USA); 14-17 Jun 1988)			
6	15:48654	*See* IS-M–619			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8806243–		(DPF summer study: Snowmass '88: high energy physics in the 1990s; Snowmass, CO (USA); 27 Jun - 15 jul 1988)			
48	15:49907	*See* FSU-HEP–881011			
CONF-8806393–		(CEC contractors' meeting on energy efficiency in industrial processes, future R&D requirements; Brussels (Belgium); 30 Jun - 1 jul 1988)			
	15:48808	*See* EUR–12046			
CONF-8806490–		(CEC contractors' meeting on industrial processes; Brussels (Belgium); 29 Jun 1988)			
	15:48809	*See* EUR–12246			
CONF-8806491–		(22. reaction mechanisms conference; Pittsburgh, PA (USA); 12-16 Jun 1988)			
1	15:49034	*See* IS-M–620			
CONF-8808142–		(16. international congress of genetics; Toronto (Canada); 20-27 Aug 1988)			
Pt.1	15:49653	National Research Council of Canada, Ottawa, Canada K1A 0R6			ND-408
Pt.2	15:49654	National Research Council of Canada, Ottawa, Canada K1A 0R6			ND-408
CONF-8809294–		(1. Rio symposium on furnace atomic absorption spectrometry; Rio de Janeiro (Brazil); 18-23 Sep 1988)			
	15:48986	*See* CBPF-MO–001/89			
CONF-8809496–		(1. international conference on environment induced cracking of metals; Kohler, WI (USA); Sep 1988)			
	15:48893	*See* N–90-24405			
CONF-880955–		(International conference on the physics of multiply charged ions and international workshop on E.C.R. ion sources; Grenoble (France); 12-16 Sep 1988)			
	15:50110	*See* CEA-CONF–9884			
CONF-880969–		(International symposium on metal-hydrogen systems, fundamentals and applications; Stuttgart (Germany, F.R.); 4-9 Sep 1988)			
12	15:50074	*See* IS-M–634			
CONF-881009–		(LIMET'88: 4. international conference on liquid metal engineering and technology; Avignon (France); 17-21 Oct 1988)			
	15:48859	*See* CEA-CONF–9407			
CONF-881013–		(JIGASTOCK '88: international conference on applied geothermal energy and thermal energy storage; Versailles (France); 18-21 Oct 1988)			
6	15:48687	*See* CEA-CONF–9684			
CONF-8810234–		(Workshop on the physics of compressible turbulent mixing; Princeton, NJ (USA); 24-27 Oct 1988)			
	15:50166	*See* CEA-CONF–9890			
CONF-8810430–		(Workshop on current direction in atmospheric processes over complex terrain; Park City, UT (USA); 24-28 Oct 1988)			
	15:49458	*See* DOE/ER/60954–1			
CONF-8810509–		(Technical committee on use of expert systems in nuclear safety; Vienna (Australia); 17 Oct 1988)			
	15:48242	*See* IAEA-TECDOC–555			
CONF-8810523–		(B. F. Ruth memorial symposium; Ames, IA (USA); 12 Oct 1988)			
1	15:48095	*See* IS-M–628			
CONF-8810526–		(Conference on Z-Pinch and Plasma Focus; Nice (France); 10-11 Oct 1988)			
	15:50111	*See* CEA-CONF–9885			
CONF-8810529–		(9. regular meeting of the international working group on reliability of reactor pressure components; Vienna (Austria); 18-20 Oct 1988)			
	15:48520	*See* IWGRRPC–88-2			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8811175–		(Beyond the standard model; Ames, IA (USA); 18-22 Nov 1988)			
	15:49908	*See* FSU-HEP–890130			
CONF-8811288–		(3. affordable comfort; Pittsburgh, PA (USA); 29 Nov - 1 dec 1988)			
	15:48797	Action-Housing, Inc., Two Gateway Center, Pittsburgh, PA 15222			
CONF-8812137–		(Workshop on infrared spectroscopy in astronomy; Salamanca (Spain); 7-9 Dec 1988)			
	15:49750	*See* ESA-SP–290			
CONF-8901206–		(Winter Conference on Spectrochemistry; Reutte (Austria); 9-13 Jan 1989)			
	15:48990	*See* CEA-CONF–9880			
CONF-890197–		(Workshop on advanced accelerator concepts; Lake Arrowhead, CA (USA); 9-13 Jan 1989)			
	15:49226	American Inst. of Physics, 335 E. 45th St., New York, NY 10017			ND-414
CONF-890238–		(Annual meeting and exhibit of the Society of Mining Engineers, Inc.; Las Vegas, NV (USA); 27 Feb - 2 mar 1989)			
6	15:48104	*See* IS-M–644			
CONF-890274–		(International symposium on near-future chemistry in nuclear energy field; Ibaraki-Ken (Japan); 15-16 Feb 1989)			
2	15:48995	*See* IS-M–618			
CONF-890310–		(7. international conference on fracture (ICF-7); Houston, TX (USA); 20-24 Mar 1989)			
6	15:48919	*See* IS-M–631			
7	15:48877	*See* IS-M–623			
CONF-8903173–		(Annual technical conference on filtration and separation; Pittsburgh, PA (USA); 27-29 Mar 1989)			
2	15:48088	*See* IS-M–629			
CONF-8903243–		(Contribution to the Meeting of Saturne Theoreticians on Heavy Meson Production and Strangeness in Nuclei; Saclay (France); 16-17 Mar 1989)			
	15:49920	*See* CEA-CONF–10024			
CONF-8903244–		(Seminar of CMEA experts on plasma diagnostics in T-15 tokamak; Liblice (Czechoslovakia); 15-16 Mar 1989)			
	15:50133	*See* IPPCZ–293/III			
CONF-890402–		(10. international conference on fluidized-bed combustion; San Francisco, CA (USA); 30 Apr - 3 may 1989)			
11	15:48116	*See* IS-M–650			
CONF-8904257–		(Quantum fluids and solids; Gainesville, FL (USA); 24-28 Apr 1989)			
	15:49866	*See* CEA-CONF–10028			
	15:49867	*See* CEA-CONF–10029			
CONF-890437–		(Corrosion '89; New Orleans, LA (USA); 17-21 Apr 1989)			
	15:48294	National Assoc. of Corrosion Engineers, P.O. Box 218340, Houston, TX 77218 (USA)			
CONF-8904376–		(Technical committee/workshop on computer aided safety analysis; Berlin (German Democratic Republic); 17-21 Apr 1989)			
	15:48653	*See* IAEA-TC–560.03			
CONF-8904378–		(HFR Colloquium; PETTEN (Netherlands); 20-21 Apr 1989)			
	15:48621	*See* EUR–12522			
CONF-8905115–		(2. international workshop on real-time computing of the environmental consequences of an accidental release to the atmosphere from a nuclear installation; Luxembourg (Luxembourg); 16-19 May 1989)			
	15:48639	*See* CEA-DAS–617			
CONF-8905141–		(5. international conference on electrostatic accelerators and associated boosters; Strasbourg (France); 24-27 May 1989)			
	15:49242	*See* CRN-VIV–64			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8905232–		(4. workshop on perspectives in nuclear physics at intermediate energies; Trieste (Italy); 8-12 May 1989)			
	15:49921	*See* CEA-CONF–10026			
CONF-8905344–		(ASTM symposium on quantitative methods in assessment of standard defects; Kansas City, MO (USA); 25-26 May 1989)			
1	15:49189	*See* IS-M–627			
CONF-8906160–					
	15:49995	*See* IPNO-DRE–89-21			
CONF-890617–		(2. Karlsruhe international conference on analytical chemistry in nuclear technology; Karlsruhe (Germany, F.R.); 5-9 Jun 1989)			
	15:48991	*See* CEA-CONF–10032			
CONF-8906359–		(Colloquium on Physical Processes in Fragmentation and Star Formation; Rome (Italy); 5-11 Jun 1989)			
	15:49747	*See* CEA-CONF–10033			
CONF-890639–		(29. annual conference of the Canadian Nuclear Association and the 10th annual conference of the Canadian Nuclear Society; Toronto (Canada); 4-7 Jun 1989)			
	15:48787	*See* OMAF–89-4057			
CONF-890686–		(International conference on new aspects of nuclear spectroscopy; Crete (Greece); 25 Jun - 1 jul 1989)			
	15:50015	*See* CEA-CONF–9976			
CONF-890708–		(16. international conference on the physics of electronic and atomic collisions; New York, NY (USA); 25 Jul - 1 aug 1989)			
	15:49868	American Institute of Physics, 335 E. 45th Street, New York, NY 10017			ND-411
CONF-8907114–		(International conference on martensitic phase transformations (ICOMAT-89); Sydney (Australia); 3-7 Jul 1989)			
4	15:48898	*See* UCRL-JC–104721			
CONF-8907127–		(12. International Conference on Few Body Problems in Physics; Vancouver (Canada); 2-8 Jul 1989)			
	15:49903	*See* CEA-CONF–9959			
	15:49904	*See* CEA-CONF–10040			
CONF-8907215–		(Health physics society annual meeting; Albuquerque, NM (USA); Jul 1989)			
1	15:49557	*See* WHC-SA–0483			
CONF-8907216–		(2. international workshop of non-crystalline solids; San Sebastian (Spain); 11-15 Jul 1989)			
1	15:48879	*See* IS-M–638			
CONF-8907217–		(8. Symposium on Theoretical Physics; Sokcho (Republic of Korea); 3-8 Jul 1989)			
	15:49963	*See* CEA-CONF–10037			
CONF-890754–		(6. international topical meeting on photoacoustic and photothermal phenomena; Baltimore, MD (USA); 31 Jul - 3 aug 1989)			
2	15:48996	*See* IS-M–636			
CONF-890794–		(3. American Society of Civil Engineers/American Society of Mechanical Engineers mechanics conference; San Diego, CA (USA); 9-12 Jul 1989)			
2	15:49898	*See* LA-UR–90-2638			
CONF-890807–		(Symposium on reclamation: a global perspective; Calgary (Canada); 27-31 Aug 1989)			
	15:49413	*See* RRTAC–89-2-Vol.1			
	15:49414	*See* RRTAC–89-2-Vol.2			
CONF-890819–		(ASME/AIChE national heat transfer conference; Philadelphia, PA (USA); 6-9 Aug 1989)			
29	15:48114	*See* IS-M–647			
30	15:48115	*See* IS-M–648			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-890826–		(International nuclear physics and cosmology conference; Sao Paulo (Brazil); 20-26 Aug 1989)			
	15:50013	*See* CEA-CONF–9955			
CONF-890872–		(Workshop on physics at Fermilab in the 1990's; Breckenridge, CO (USA); 15-24 Aug 1989)			
15	15:49250	*See* FNAL-TM–1674			
CONF-890903–		(International Europhysics conference on high-energy physics; Madrid (Spain); 6-14 Sep 1989)			
	15:49915	*See* LAL–8935			
CONF-8909262–		(International symposium on muon catalyzed fusion μCF - 89; Oxford (UK); 10-13 Sep 1989)			
	15:50182	*See* RAL–90-022			
CONF-891015–		(42. Canadian geotechnical conference; Winnipeg (Canada); 23-25 Oct 1989)			
	15:49744	*See* WAU/CGS–CE03140			
CONF-8910237–		(International school seminar on heavy ion physics; Dubna (USSR); 3-12 Oct 1989)			
	15:50012	*See* GANIL-P–8921			
CONF-891024–		(The Metallurgical Society fall meeting: materials week; Indianapolis, IN (USA); 1-5 Oct 1989)			
8	15:48957	*See* IS-M–645			
9	15:48880	*See* IS-M–646			
CONF-8910299–		(National Educators workshop; Norfolk, VA (USA); 17-19 Oct 1989)			
	15:48853	*See* N–90-24350			
CONF-8910346–		(Conference on indirect methods for estimating hydraulic properties; Riverside, CA (USA); 11-13 Oct 1989)			
2	15:48287	*See* PNL-SA–17566			
CONF-8910450–		(3. users meeting for the advanced photon source (APS); Argonne, IL (USA); 12-13 Oct 1989)			
	15:49224	*See* ANL/APS-CP–3			
CONF-8910455–		(Let's clear the air; Toronto (Canada); 18 Oct 1989)			
	15:48842	*See* CRFA–90-01413			
CONF-8910457–		(IAEA technical committee meeting on reactivity transients accidents; Vienna (Austria); 14-17 Oct 1989)			
	15:48541	*See* CEA-DAS–668			
CONF-8910458–		(IAEA advisory group meeting on handling and retention of airborne radionuclides at nuclear power plants during abnormal operations; Vienna (Austria); 16-20 Oct 1989)			
	15:48540	*See* CEA-DAS–666			
CONF-891119–		(Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989)			
140	15:48910	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017836	MF-404
CONF-8911216–					
	15:50002	*See* CENBG–8937			
	15:50003	*See* CENBG–8938			
CONF-8911222–		(26. PNWIS Pacific Northwest international section's annual meeting; Spokane, WA (USA); 8-10 Nov 1989)			
1	15:48442	*See* PNL-SA–17279			
CONF-8911224–		(Workshop on aquifer thermal energy storage (ATES) modeling system; Seattle, WA (USA); 30 Nov - 1 dec 1989)			
1	15:48690	*See* PNL–7441			
CONF-8911228–		Tokai (Japan); 6-7 Nov 1989)			
	15:49259	*See* JAERI-M–90-072			
CONF-8911229–		(IAEA specialist meeting on plutonium and uranium recycling; Cadarache (France); 13-16 Nov 1989)			
	15:48543	*See* CEA-DAS–672			
CONF-8911230–		(Environmental research: technology transfer conference; Toronto (Canada); 20-21 Nov 1989)			
	15:48733	*See* OE/RT–90-03626-Vol.2			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-891130–		(3. international conference on processing and utilization of high-sulphur coals; Ames, IA (USA); 14-18 Nov 1989)			
5	15:48089	*See* IS-M–649			
CONF-891177–		(International conference on pressurized water reactors: the PWR - the present and future of Europe's nuclear energy; London (UK); 6-7 Nov 1989)			
	15:48542	*See* CEA-DAS–669			
CONF-900133–		(International conference on superconductivity; Bangalore (India); 10-14 Jan 1990)			
3	15:48922	*See* IS-M–641			
CONF-900142–		(Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium; San Francisco, CA (USA); 15-19 Jan 1990)			
	15:48615				
	15:48616				
	15:48617				
	15:48670				
	15:48671				
	15:48686				
	15:48940				
	15:49175				
	15:49176				
	15:49222				
	15:49267				
	15:49268				
	15:49269				
	15:49270				
	15:49271				
	15:49272				
	15:49273				
	15:49274				
	15:49281				
	15:49320				
	15:49321				
	15:49322				
	15:49323				
	15:49324				
	15:49325				
	15:49326				
	15:49327				
	15:49328				
	15:49329				
	15:49330				
	15:49331				
	15:49332				
	15:49333				
	15:49334				
	15:49335				
	15:49336				
	15:49337				
	15:49338				
	15:49339				
	15:49340				
	15:49341				
	15:49342				
	15:49343				
	15:49344				
	15:49345				
	15:49346				
	15:49347				
	15:49348				
	15:49349				
	15:49350				
	15:49351				
	15:49352				
	15:49353				
	15:49354				
	15:49355				
	15:49356				

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
	15:49357				
	15:49358				
	15:49359				
	15:49360				
	15:49361				
	15:49362				
	15:49363				
	15:49364				
	15:49368				
	15:49369				
	15:49370				
	15:49371				
	15:49372				
	15:49373				
	15:49374				
	15:49375				
	15:49376				
	15:49401				
	15:49561				
	15:49562				
	15:49563				
	15:49564				
	15:49699				
	15:49700				
	15:49701				
	15:49702				
	15:49703				
	15:50064				
	15:50245				
	15:50246				
	15:50248				
CONF-900183–		(Recontres De Moriond '90: new and exotic phenomena; Les Arcs (France); 20-27 Jan 1990)			
	15:49977	*See* MPI-PAE/Exp.El.–226			
CONF-900190–		(Synchrotron x-ray sources and new opportunities in the soil and environmental sciences: workshop report; Argonne, IL (USA); 8-10 Jan 1990)			
	15:49565	*See* ANL/APS/TM–7			
CONF-9002131–		(Workshop on asymptotic analysis and numerical solution of partial differential equations; Argonne, IL (USA); 26-28 Feb 1990)			
3	15:50215	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017674	MF-405
CONF-9002139–		(Probabilistic safety assessment and management conference (PSAM); Beverly Hills, CA (USA); 4-7 Feb 1990)			
1	15:48660	*See* LA-UR–90-2777			
CONF-900221–		(International symposium on interfacial reactions in metal or ceramics matrix composites; Anaheim, CA (USA); 19-22 Feb 1990)			
	15:48969	*See* N–90-24382			
CONF-9003159–		(Workshop on radiation hardness of plastic scintillator; Tallahassee, FL (USA); 19-21 Mar 1990)			
2	15:49286	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017448	MF-414
CONF-9003200–		(Society of photo-optical institution engineering (SPIE) applications of neural networks; Orlando, FL (USA); 16-19 Mar 1990)			
1	15:50239	*See* PNL-SA–18095			
CONF-9003201–		(Meeting of the American society for nondestructive testing; Columbus, OH (USA); 15 Mar 1990)			
	15:48967	*See* N–90-23754			
CONF-9003202–		(International industrial symposium on the supercollider; Miami Beach, FL (USA); 14-16 Mar 1990)			
1	15:49293	*See* FSU-HEP–041090			
CONF-9003203–		(Canadian developments in testing concrete aggregates for alkali-aggregate reactivity; Toronto (Canada); 19 Mar 1990)			
	15:48955	*See* EM–92			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9003204–		(7. annual heavy oil and oil sands technical symposium; Calgary (Canada); 14 Mar 1990)			
	15:48192	*See* CU/FCE–CE03118			
CONF-900321–		(18. INS international symposium on physics with high-intensity hadron accelerators; Tokyo (Japan); 14-16 Mar 1990)			
1	15:49265	*See* TRI-PP–90-25			
CONF-900331–		(Workshop on heavy ion physics at the alternating gradient synchrotron (HIPAGS); Upton, NY (USA); 3-7 Mar 1990)			
	15:49978	*See* BNL–44911			
CONF-900406–		(1. international topical meeting on high-level radioactive waste management; Las Vegas, NV (USA); 8-12 Apr 1990)			
	15:48295	American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 (USA)			
CONF-9004133–		(American power conference; Chicago, IL (USA); 23-25 Apr 1990)			
6	15:48486	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017873	MF-104
CONF-9004136–		(5. IEEE symposium on electromagnetic launch technology; Destin, FL (USA); 1-5 Apr 1990)			
9-Rev.	15:49167	*See* UCRL–101932-Rev.1			
CONF-9004177–		(Advanced computing for the social sciences conference; Williamsburg, VA (USA); 10-12 Apr 1990)			
3	15:48699	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017328	MF-400
CONF-9004209–		(Workshop on the science of intense radioactive ion beams; Los Alamos, NM (USA); 10-12 Apr 1990)			
7	15:50023	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017805	MF-413
CONF-900448–		(12. annual American Society of Mechanical Engineers (ASME) international solar energy conference; Miami, FL (USA); 1-4 Apr 1990)			
10	15:48783	*See* LBL–28197			
CONF-900450–		(Nuclear structure in the '90's; Oak Ridge, TN (USA); 23-27 Apr 1990)			
11	15:50011	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017666	MF-413
CONF-900465–		(Spring meeting of the Materials Research Society; San Francisco, CA (USA); 16-21 Apr 1990)			
83	15:48972	*See* PNL-SA–17678			
84	15:48973	*See* SAND–90-0881C			
85	15:48860	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017856	MF-404
CONF-900489–		(5. international conference on muon spin rotation, relaxation and resonance; Oxford (UK); 9-12 Apr 1990)			
3	15:48923	*See* IS-M–642			
CONF-9005187–		(Specialists meeting on uncertainties in physics calculations for gas-cooled reactor cores; Villigen (Switzerland); 9-11 May 1990)			
2	15:48573	*See* GA-A–20115			
CONF-9005257–		(International school on nuclear physics; Kiev (USSR); 28 May - 8 jun 1990)			
1	15:50001	*See* LBL–29361			
CONF-9005265–		(3. International Atomic Energy Agency (IAEA) specialists' meeting on subcritical crack growth; Moscow (USSR); 14-17 May 1990)			
Vol.1	15:48537	*See* NUREG/CP–0112-Vol.1			
Vol.2	15:48538	*See* NUREG/CP–0112-Vol.2			
CONF-9005267–		(7. international association for hydraulic research cooling tower and spraying pond symposium; Leningrad (USSR); 29 May - 2 jun 1990)			
	15:48601	*See* EPRI-GS–6976			
CONF-9005269–		(Western states and provinces workshop; Eruka, CA (USA); 15-17 May 1990)			
1	15:49640	*See* PNL-SA–17865			
CONF-9005270–		(Thermodynamics of alloys conference; Barcelona (Spain); 23-26 May 1990)			
1	15:48868	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017661	MF-401

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9005273--		(International workshop on exotic atoms in condensed matter; Erice (Italy); 19-25 May 1990)			
1	15:49894	*See* TRI-PP-90-22			
CONF-900534--		(18. NATO/CCMS international technical meeting on air pollution modelling and its applications; Vancouver (Canada); 13-17 May 1990)			
4	15:49456	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017676	MF-402
CONF-900546--		(4. conference on fossil energy materials; Oak Ridge, TN (USA); 15-17 May 1990)			
14	15:48105	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017865	MF-103
CONF-900562--		(Spring meeting of the Electrochemical Society; Montreal (Canada); 6-11 May 1990)			
8	15:48949	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017704	MF-401
CONF-900570--		(8. international conference on ultrarelativistic nucleus-nucleus collisions: Quark Matter '90; Menton (France); 7-11 May 1990)			
11	15:49918	*See* BNL--45004			
CONF-900577--		(Symposium on surface processing and laser assisted chemistry in conjunction with the spring meeting of the European Materials Research Society; Strasbourg (France); 29 May - 1 jun 1990)			
2	15:48861	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017861	MF-404
3	15:48911	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017798	MF-401; MF-411
CONF-900579--		(Seminar on new separation chemistry for radioactive waste and other specific applications; Rome (Italy); 13-18 May 1990)			
2	15:48257	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017802	MF-401
CONF-900591--		(2. Fuel cells contractors review meeting; Morgantown, WV (USA); 2-3 May 1990)			
	15:48760	*See* DOE/METC--90/6112			
CONF-900601--		(12. international conference on particles and nuclei; Cambridge, MA (USA); 24-29 Jun 1990)			
8	15:49979	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017807	MF-413
9	15:49277	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017800	MF-413
11	15:50000	*See* LA-UR--90-3255			
CONF-900603--		(2. European particle accelerator conference; Nice (France); 11-16 Jun 1990)			
34	15:49225	*See* BNL--43923			
35	15:49275	*See* BNL--43928			
36	15:49236	*See* LBL--28189			
CONF-9006105--		(28. symposium on engineering aspects of magnetohydrodynamics; Chicago, IL (USA); 26-28 Jun 1990)			
12	15:48107	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017831	MF-103
CONF-9006168--		(INFOTECH '90: DOE technical meeting; Oak Ridge, TN (USA); 20-21 Jun 1990)			
1	15:50255	*See* PNL-SA--17925			
CONF-9006176--		(19. power modulator symposium; San Diego, CA (USA); Jun 1990)			
15	15:49220	*See* UCRL-JC--103328			
CONF-9006212--		(International symposium on nuclear astrophysics: nuclei in the cosmos; Vienna (Austria); 18-22 Jun 1990)			
3-Rev.1	15:49836	*See* UCRL-JC--104223-Rev.1			
CONF-900623--		(15. symposium on effects of radiation on materials; Nashville, TN (USA); 17-21 Jun 1990)			
17	15:48217	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017670	MF-904
18	15:48862	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017691	MF-404
19	15:50167	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017863	MF-423
CONF-9006243--		(8. beta battery workshop; Chester (UK); 12-18 Jun 1990)			
3	15:48838	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017667	MF-212
CONF-9006263--		(TAE user's conference; League City, TX (USA); 5-7 Jun 1990)			
1	15:48987	*See* PNL-SA--18212			
CONF-9006267--		(1990 DPF summer study on high energy physics; Snowmass, CO (USA); 25 Jun - 13 jul 1990)			
3	15:49924	*See* DOE/ER/05490--112			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9006269–		(12. annual meeting of the bioelectromagnetics society; San Antonio, TX (USA); 10-14 Jun 1990)			
1	15:49730	*See* PNL-SA–18290			
CONF-9006270–		(IAIA '90 conference; Lausanne (Switzerland); 26-30 Jun 1990)			
1	15:48259	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017662	MF-511
CONF-9006274–		(12. PANIC international conference on particles and nuclei; Cambridge (UK); 25-29 Jun 1990)			
1	15:50051	*See* TRI-PP–90-44			
CONF-900628–		(17. international conference for the electric power industry: reliability, availability, maintainability strategies for the 90's; Hershey, PA (USA); 12-15 Jun 1990)			
3	15:48485	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017838	MF-101
CONF-900631–		(International conference on pollution prevention: clean technologies and clean products–the environmental challenge of the 1990's; Washington, DC (USA); 10-13 Jun 1990)			
3	15:48071	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017663	MF-109
4	15:48091	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017679	MF-630
CONF-900676–		(83. annual meeting and exhibition of the Air and Waste Management Association; Pittsburgh, PA (USA); 24-29 Jun 1990)			
12	15:48825	*See* PNL-SA–17985			
14	15:49457	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017675	
CONF-900694–		(11. annual meeting of the Canadian Radiation Protection Association; Saint John (Canada); 11-13 Jun 1990)			
1	15:48258	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017678	MF-511
CONF-900708–		(Low temperature engineering and cryogenics conference; Southampton (UK); 17-19 Jul 1990)			
1	15:49251	*See* FNAL-TM–1676			
CONF-9007106–		(Institute of nuclear materials management conference; Los Angeles, CA (USA); 15-18 Jul 1990)			
58	15:48393	*See* RFP–4433			
61	15:48851	*See* UCRL-JC–104359			
70	15:48395	*See* UCRL-JC–104361			
72	15:48388	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017686	MF-526
CONF-9007131–		(3. international conference on the structure of surfaces; Milwaukee, WI (USA); 9-12 Jul 1990)			
2	15:48878	*See* IS-M–637			
CONF-9007141–		(Workshop on heavy-ion collisions at energies near the Coulomb barrier; Daresbury (UK); 5-7 Jul 1990)			
3	15:50024	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017692	MF-413
CONF-9007159–		(End-use load and its role in DSM; Irvine, CA (USA); 11-12 Jul 1990)			
1	15:48795	*See* PNL-SA–18436			
CONF-900716–		(12. international conference on atomic physics; Ann Arbor, MI (USA); 30 Jul - 3 aug 1990)			
1	15:49895	*See* UCRL-JC–104665			
CONF-9007162–		(Spectroscopy across the spectra; Hertford (UK); 9-12 Jul 1990)			
1	15:49025	*See* PNL-SA–18081			
CONF-9007167–		(STM90'/Nano 1 conference; Baltimore, MD (USA); 23-27 Jul 1990)			
1	15:49377	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017317	MF-411
CONF-9007169–		(Utility interest group meeting; Dallas, TX (USA); 10-11 Jul 1990)			
1	15:48497	*See* PNL-SA–18353			
CONF-9007170–		(Current developments in control systems for SO_2 emissions; Washington, DC (USA); 17-18 Jul 1990)			
1	15:48500	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017685	MF-105

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-900720–		(26. AIAA/SAE/ASME/ASEE joint propulsion conference and exhibit; Orlando, FL (USA); 16-18 Jul 1990)			
	15:49192	*See* N–90-23591			
	15:49193	*See* N–90-24349			
CONF-900721–		(25. anniversary conference and exhibition of the International Association on Water Pollution Research and Control; Kyoto (Japan); 29 Jul - 3 aug 1990)			
	15:49156	*See* N–90-23518			
CONF-900724–		(5. international conference on indoor air quality and climate; Toronto (Canada); 29 Jul - 3 aug 1990)			
Vol.1	15:48774	*See* DOE/ER/60888–1-Vol.1			
Vol.2	15:48775	*See* DOE/ER/60888–1-Vol.2			
Vol.3	15:48776	*See* DOE/ER/60888–1-Vol.3			
Vol.4	15:48777	*See* DOE/ER/60888–1-Vol.4			
Vol.5	15:48778	*See* DOE/ER/60888–1-Vol.5			
CONF-900731–		(NATO Advisory Study Institute on diamond and diamond-like films; Castelvecchio Pascoli (Italy); 22 Jul - 2 aug 1990)			
2	15:48912	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017758	MF-404
CONF-900756–		(SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit; San Diego, CA (USA); 8-13 Jul 1990)			
16-Rev.1	15:49652	*See* UCRL–102523-Rev.1			
40	15:49395	*See* UCRL-JC–104276			
41	15:50097	*See* IS-M–643			
CONF-900757–		(15. international conference on x-ray and inner-shell processes; Knoxville, TN (USA); 9-13 Jul 1990)			
5	15:49187	NTIS, PC A03/MF A01 - OSTI		DE90017327	MF-404
CONF-900791–		(Review of progress in quantitative NDE; La Jolla, CA (USA); 15-20 Jul 1990)			
2	15:49318	*See* UCRL-JC–103762			
CONF-900801–		(25. intersociety energy conversion engineering conference; Reno, NV (USA); 12-17 Aug 1990)			
	15:48459	*See* N–90-23662			
26	15:48469	*See* DOE/NASA/33408–4			
29	15:48097	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017673	MF-101
32	15:48499	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017797	MF-105
33	15:48106	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017858	MF-112
CONF-900802–		(200. American Chemical Society national meeting; Washington, DC (USA); 26-31 Aug 1990)			
7	15:49869	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017680	MF-401
10	15:49033	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017839	MF-401
CONF-900804–		(International topical meeting on fast reactor safety; Snowbird, UT (USA); 12-16 Aug 1990)			
32	15:48640	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017672	MF-542
CONF-900813–		(International conference on the chemistry of electronic ceramic materials; Grand Teton National Park, WY (USA); 16-21 Aug 1990)			
1	15:48913	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017669	MF-404
CONF-9008134–		(1990 national conference of standards laboratories (NCSL) symposium and workshop; Washington, DC (USA); 19-23 Aug 1990)			
3	15:49386	*See* Y/IB–20			
CONF-900814–		(7. ASTM-EURATOM symposium on reactor dosimetry; Strasbourg (France); 27-31 Aug 1990)			
13	15:49980	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017857	MF-413
CONF-9008149–		(SERI workshop on the role of point defects/defect complexes in silicon device fabrication; Keystone, CO (USA); 30-31 Aug 1990)			
Absts.	15:48461	*See* SERI/CP–211-3976			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9008152–		(Predeal international summer school recent advances in nuclear structure; Precdeal (Romania); 31 Aug - 8 sep 1990)			
1	15:50020	*See* BNL–45010			
CONF-900819–		(International conference on electric machines; Cambridge, MA (USA); 13-15 Aug 1990)			
1	15:48914	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017791	MF-364
CONF-900822–		(25. IUPAP international conference on high energy physics; Singapore (Singapore); 2-8 Aug 1990)			
9	15:49905	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017404	MF-414
CONF-900830–		(5. international conference on solid films and surfaces; Providence, RI (USA); 13-17 Aug 1990)			
2	15:48915	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017806	MF-404
CONF-900854–		(3. electronic materials and processing congress; San Francisco, CA (USA); 20-24 Aug 1990)			
1	15:48897	*See* SAND–90-2108C			
CONF-900856–		(6. international conference on molecular beam epitaxy; La Jolla, CA (USA); 27-31 Aug 1990)			
1	15:48979	*See* SAND–90-2282C			
CONF-900873–		(1. international topical meeting on neutron radiography system design and characterization; Pembroke (Canada); 28-30 Aug 1990)			
2	15:48620	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017829	MF-535
3	15:48402	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017830	MF-535
CONF-900877–		(12. international congress for electron microscopy; Seattle, WA (USA); 12-18 Aug 1990)			
7	15:50235	*See* MLM–3656(OP)			
CONF-9009108–		(International meeting on reduced enrichment for research and test reactors; Newport, RI (USA); 23-27 Sep 1990)			
1	15:48609	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017817	MF-940
CONF-900912–		(8. international conference on atomic masses and fundamental constants; Jerusalem (Israel); 9-14 Sep 1990)			
2	15:50021	*See* BNL–45011			
3	15:50019	*See* BNL–45009			
CONF-9009123–		(Linear accelerator conference; Albuquerque, NM (USA); 9-14 Sep 1990)			
2	15:49240	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017694	MF-413
3	15:49241	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017819	MF-413
5	15:49237	*See* UCRL-JC–103797			
CONF-9009135–		(International conference on high spin physics and gamma-soft nuclei; Pittsburgh, PA (USA); 17-21 Sep 1990)			
1	15:50018	*See* BNL–45008			
CONF-900914–		(Vibrations at surfaces; Shelter Island, NY (USA); 10-14 Sep 1990)			
1	15:50068	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017735	MF-411
CONF-9009141–		(International symposium on metal-hydrogen systems; Banff (Canada); 2-7 Sep 1990)			
4	15:50075	*See* IS-M–639			
5	15:50076	*See* IS-M–640			
2-Rev.1	15:48883	*See* K/CSD/INF–89/42/R1			
CONF-9009154–		(IEEE international professional communication conference; London (UK); 12-14 Sep 1990)			
2	15:50254	*See* LA-UR–90-2637			
CONF-9009164–		(2. international symposium on gas transfer at water surfaces; Minneapolis, MN (USA); 11-14 Sep 1990)			
2	15:49589	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017762	MF-402
CONF-9009166–		(12. international free electron laser conference (FEL-12); Paris (France); 17-21 Sep 1990)			
3	15:49238	*See* UCRL-JC–103825			
CONF-9009174–		(5. international symposium on resonance ionization spectroscopy and its applications; Varese (Italy); 16-21 Sep 1990)			
1	15:48992	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017334	MF-401
2	15:49206	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017743	MF-406; MF-404

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
3	15:49871	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017761	MF-410
4	15:49872	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000557	MF-406
CONF-9009200–		(1990 LINAC conference; Albuquerque, NM (USA); 10-14 Sep 1990)			
9	15:49893	*See* SAND–90-2317C			
11	15:49266	*See* UCRL-JC–103783			
13	15:49239	*See* BNL–44625			
14	15:50202	*See* SAND–90-1346C			
CONF-9009234–		(Symposium on laboratory robotics; Boston, MA (USA); 16-19 Sep 1990)			
1	15:49644	*See* LA-UR–90-2856			
CONF-9009236–		(9. international conference on textures of materialss; Avignon (France); 17-21 Sep 1990)			
1	15:48887	*See* LA-UR–90-2828			
CONF-9009238–		(National conference on energy research enhancement and technology transfer for industry and higher education; Kingsville, TX (USA); 16-18 Sep 1990)			
1	15:48460	*See* SAND–90-2272C			
CONF-900924–		(9. international symposium on high energy spin-physics; Bonn (Germany, F.R.); 10-15 Sep 1990)			
2	15:49230	*See* BNL–45013			
CONF-9009243–		(Ethanol from biomass annual meeting; Lincoln, NE (USA); 12-13 Sep 1990)			
1	15:49642	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017324	MF-408
CONF-9009247–		(International ion chromatography symposium; San Diego, CA (USA); 30 Sep - 3 oct 1990)			
1	15:49209	*See* KCP–613-4404			
CONF-9009248–		(19. international congress on high speed photography and photonics; Cambridge (UK); 16-22 Sep 1990)			
1	15:49382	*See* UCRL–102843			
2	15:49381	*See* UCRL–102842			
CONF-9009251–		(13. annual Madison waste conference; Madison, WI (USA); 19-20 Sep 1990)			
1	15:49566	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017659	MF-403
CONF-9009255–		(IAEA working group on fast reactors, IWGFR specialists' meetings on steam generators; Aix-En-Provence (France); 26 Sep - 3 oct 1990)			
1	15:48581	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017826	MF-531
CONF-9009256–		(NATO advanced research workshop on fundamental aspects of inert gases in solids; Bonas (France); 16-22 Sep 1990)			
1	15:48218	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017813	MF-940
CONF-900936–		(7. international conference on ion beam modification of materials; Knoxville, TN (USA); 9-14 Sep 1990)			
2	15:48950	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017759	MF-404
3	15:48863	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017815	MF-404
4	15:50069	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017736	MF-411
5	15:48951	NTIS, PC A03/MF A01 - OSTI		DE90017769	MF-404
6	15:48864	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017744	MF-404
8	15:49083	*See* SAND–2302C			
CONF-900944–		(Applied superconductivity conference; Aspen, CO (USA); 24-28 Sep 1990)			
2	15:49205	NTIS, PC A03/MF A01 - OSTI		DE90017812	MF-364
CONF-900964–		(5. international symposium on resonance ionization spectroscopy and its applications; Ispra (Italy); 16-21 Sep 1990)			
2	15:49870	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017768	MF-401
CONF-900970–		(International conference on Monte Carlo methods in neutron and photon transport; Budapest (Hungary); 25-28 Sep 1990)			
3	15:50052	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017809	MF-505
CONF-900975–		(5. international symposium on small particles and inorganic clusters; Konstanz (Germany, F.R.); 10-14 Sep 1990)			
1	15:48865	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017688	MF-401

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-900989–		(European community wind energy conference and exhibition; Madrid (Spain); 10-14 Sep 1990)			
1	15:48484	*See* SERI/TP–257-3939			
CONF-901007–		(9. topical meeting on technology of fusion energy; Oak Brook, IL (USA); 7-11 Oct 1990)			
2	15:50168	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017740	MF-420
CONF-9010158–		(9. IEEE/CHMT international electronics manufacturing technology symposium; Washington, DC (USA); 1-3 Oct 1990)			
2	15:49191	*See* SAND–2033C			
CONF-9010166–		(6. annual Department of Energy model conference on waste management and environmental restoration; Oak Ridge, TN (USA); 29 Oct - 2 nov 1990)			
1	15:49742	*See* SAND–90-1126C			
2	15:48726	*See* SAND–90-1008C			
CONF-9010172–		(61. shock and vibration symposium; Pasadena, CA (USA); 16-18 Oct 1990)			
3	15:49190	*See* SAND–90-1323C			
CONF-9010185–		(18. water reactor safety information meeting; Gaithersburg, MD (USA); 22 Oct 1990)			
1	15:48646	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016521	
CONF-9010190–		(12. international symposium on ballistics; San Antonio, TX (USA); 30 Oct - 1 nov 1990)			
1	15:49394	*See* UCRL–102942			
CONF-9010191–		(10. world fertilizer congress of CIEC; Nicosia (Cyprus); 21-27 Oct 1990)			
1	15:49567	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017687	MF-402
CONF-901025–		(13. international conference on plasma physics and controlled nuclear fusion research; Washington, DC (USA); 1-6 Oct 1990)			
6	15:50112	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017326	MF-420
7	15:50115	*See* DOE/ER/53198–160			
8	15:50132	*See* IAEA-CN–53/C-4-7			
CONF-901057–		(7. international symposium on capture gamma-ray spectroscopy and related topics; Pacific Grove, CA (USA); 14-19 Oct 1990)			
1	15:50022	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017810	MF-413
CONF-901067–		(Symposium on environmental radiation and public policy; Las Vegas, NV (USA); 23-25 Oct 1990)			
1	15:50063	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017747	MF-407
CONF-901073–		(178. meeting of the Electrochemical Society; Seattle, WA (USA); 14-19 Oct 1990)			
7	15:48866	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017822	MF-401; MF-404
CONF-901097–		(IAEE North American conference; Ottawa (Canada); 1-3 Oct 1990)			
1	15:48771	NTIS, PC A03/MF A01 - OSTI		DE90017022	MF-350
CONF-901101–		(American Nuclear Society winter meeting; Washington, DC (USA); 11-15 Nov 1990)			
1	15:49164	*See* SAND–90-1200-C-Extd.Abst.			
2	15:48577	*See* LA-UR–90-1641			
3	15:48659	*See* LA-UR–90-1833			
4	15:50103	*See* LA-UR–90-1845			
5	15:50240	*See* SAND–90-1729C			
6	15:49379	*See* SAND–90-1747C			
7	15:48572	*See* EGG-M–90249			
8	15:49160	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90012979	MF-722
9	15:48229	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90012948	MF-523
10	15:48230	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90012942	MF-820
11	15:48526	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90012941	MF-820
12	15:48527	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90012934	
13	15:48479	*See* SAND–90-1696C			
15	15:49993	*See* LA-UR–90-2055			
16	15:48408	*See* LA-UR–90-2164			
17	15:48641	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90013663	MF-542
18	15:48403	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014217	MF-422
19	15:48642	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014208	MF-406
20	15:48404	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014206	MF-400

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
21	15:50060	*See* LA-UR--90-2514			
22	15:50225	*See* LA-UR--90-2577			
23	15:49994	*See* LA-UR--90-2212			
24	15:50213	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015162	MF-405
25	15:48638	*See* BNL-NUREG--44847			
27	15:48231	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015535	MF-812
28	15:48291	*See* UCRL-JC--104547			
29	15:48611	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016874	MF-530; MF-505
30	15:48643	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017695	
31	15:48644	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017689	
32	15:48579	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017745	MF-532
33	15:48224	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000398	MF-532
CONF-901104--		(22. international technical conference of the Society for the Advancement of Material and Process Engineering; Boston, MA (USA); 6-8 Nov 1990)			
1	15:49405	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014447	MF-404
CONF-901105--		(Fall meeting of the Materials Research Society; Boston, MA (USA); 26 Nov - 1 dec 1990)			
1	15:48857	*See* BNL--43758			
2	15:48932	*See* LBL--27358			
3	15:48867	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015153	MF-365
4	15:48974	*See* SAND--90-1718C			
5	15:48288	*See* SAND--90-1031C			
6	15:49892	*See* SAND--90-1676C			
7	15:48978	*See* SAND--90-2191C			
8	15:48975	*See* SAND--90-1755C			
9	15:48976	*See* SAND--90-1756C			
11	15:48952	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017763	MF-404
CONF-901109--		(International symposium on gas-liquid two-phase flows in conjunction with the winter annual meeting of the American Society of Mechanical Engineers; Dallas, TX (USA); 25-30 Nov 1990)			
1	15:48645	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90008748	
2	15:48470	*See* SAND--90-0097C			
3	15:49154	*See* EGG-M--90041			
4	15:48916	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90011180	MF-364; MF-404
5	15:49180	*See* EGG-M--90067			
6	15:49169	*See* Y/DX--943			
7	15:48870	*See* EGG-M--90064			
8	15:49177	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90013661	MF-363
9	15:48478	*See* SAND--90-0325C			
10	15:49740	*See* LA-UR--90-2571			
10	15:50241	*See* SAND--90-2034C			
11	15:48483	*See* SERI/TP--257-3795			
12	15:48580	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015543	
13	15:49166	*See* SAND--90-2053C			
14	15:48805	NTIS, PC A03/MF A01 - OSTI		DE90015598	MF-350
15	15:49743	*See* UCRL-JC--104272			
16	15:49217	*See* SAND--90-0650C			
17	15:49218	*See* SAND--90-0688C			
18	15:49161	NTIS, PC A03/MF A01 - OSTI		DE90015606	MF-350
CONF-901113--		(Japanese Section of the International Society of Respiratory Protection conference; Tokyo (Japan); 24 Nov 1990)			
1	15:49168	*See* UCRL--102264			
CONF-901121--		(Association for Computing Machinery/Institute of Electrical and Electronics Engineers supercomputing conference; New York, NY (USA); 12-16 Nov 1990)			
1	15:50242	*See* UCRL--102263-Rev.2			
2	15:50243	*See* UCRL-JC--103573			
3	15:50088	*See* UCRL-JC--103948			
4	15:49285	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90013662	MF-414
5	15:50224	*See* LA-UR--90-2564			
6	15:50053	NTIS, PC A02/MF A01; OSTI; INIS		DE90016041	MF-413; MF-414

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-901124–		(Government microcircuit applications conference: technology strategies for the 90's; Las Vegas, NV (USA); 6-8 Nov 1990)			
1	15:48977	*See* SAND–90-2153C			
2	15:49367	*See* SAND–90-2173C			
CONF-901130–		(12. annual international conference of the IEEE Engineering in Medicine and Biology Society; Philadelphia, PA (USA); 1-4 Nov 1990)			
1	15:49651	*See* LA-UR–90-1548			
2	15:49385	*See* LA-UR–90-2308			
CONF-901150–		(IEEE conference on neural information processing: natural and synthetic; Denver, CO (USA); 26-29 Nov 1990)			
1	15:50214	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90011636	MF-405
2	15:49704	*See* LA-UR–90-2562			
CONF-901160–		(Spectra '90 conference; Oak Ridge, TN (USA); Nov 1990)			
1	15:49165	*See* SAND–90-1248C			
CONF-901176–		(34. acoustic emission working group meeting; Urbana, IL (USA); 12-15 Nov 1990)			
1	15:50104	*See* RFP–4418			
CONF-901177–		(Association for the progress of new chemistry conference; Tokyo (Japan); 6-9 Nov 1990)			
1	15:48953	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015538	MF-404
CONF-901178–		(International symposium on carbon; Tsukuba (Japan); 4-8 Nov 1990)			
1	15:48600	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015545	MF-520
CONF-901179–		(CUBE: computer use by engineers symposium; Santa Fe, NM (USA); 27-30 Nov 1990)			
1	15:50244	*See* UCRL-JC–104493			
CONF-901194–		(ASME winter annual meeting; Dallas, TX (USA); 25-30 Nov 1990)			
1	15:48772	NTIS, PC A02/MF A01 - OSTI		DE90016030	MF-350
2	15:48773	NTIS, PC A02/MF A01 - OSTI		DE90016037	MF-350
CONF-901199–		(IECON '90; Pacific Grove, CA (USA); 27-30 Nov 1990)			
10	15:48612	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017333	MF-520
CONF-910120–		(3. international conference on constitutive laws for engineering materials: theory and application; Tucson, AZ (USA); 7-12 Jan 1991)			
	15:48852	*See* N–90-23773			
CPA/PD–					
90-03302	15:48169	Canadian Petroleum Association, 3800 - 150 6th. Ave. S.W., Calgary, AB, CAN T2P 3Y7. Prices: PRICES UPON REQUEST			
CRDEC-TR–					
167	15:48988	*See* AD-A–223070/4/XAB			
CRFA–					
90-01413	15:48842	PC Biomass Energy Institute Inc.,-1329 Niakwa Road East, Winnipeg, MB, CAN R2J 3T4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
CRIE-U–					
89015	15:48702	NTIS (US Sales Only), PC A03/MF A01		DE91701408	
89030	15:48487	NTIS (US Sales Only), PC A03/MF A01		DE91701399	
89032	15:48074	NTIS (US Sales Only), PC A03/MF A01		DE91701409	
89034	15:49590	NTIS (US Sales Only), PC A03/MF A01		DE91701400	
89035	15:49591	NTIS (US Sales Only), PC A03/MF A01		DE91701401	
89036	15:48122	NTIS (US Sales Only), PC A04/MF A01		DE91701407	
89046	15:48673	NTIS (US Sales Only), PC A03/MF A01		DE91701391	
CRIE-Y–					
90001	15:48683	NTIS (US Sales Only), PC A03/MF A01		DE91701404	
90002	15:48685	NTIS (US Sales Only), PC A03/MF A01		DE91701405	
CRN-HE–					
8906	15:49287	NTIS (US Sales Only), PC A03/MF A01		DE91702151	
CRN-VIV–					
64	15:49242	NTIS (US Sales Only), PC A02/MF A01		DE91700564	
CS–					
8918	15:50238	*See* PB–90-252727/XAB			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CSC–					
(89)ENP-28	15:48756	Available from British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ No. DX86048			
CSCE–					
CE03117	15:48443	Canadian Society for Civil Engineering, 2050 Mansfield St., Montreal, PQ, CAN . Prices: $30.00 CAN			
CTH-IEFT-PP–					
1990-03	15:50113	NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS		DE90638959	
CU/FCE–					
CE03118	15:48192	Faculty of Continuing Education, University of Calgary, 2500 University Drive, N.W., Calgary, AB, CAN T2N 1N4. Prices: PRICES UPON REQUEST			
D–					
89-9	15:48184	PC Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $5.00 CAN; MF $10 CAN			
89-10	15:48167	Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4. Prices: $5.00 CAN			
89-11	15:48182	Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4. Prices: $5.00 CAN			
90-3	15:48168	Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4. Prices: $5.00 CAN			
90-7	15:48185	Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4. Prices: $5.00 CAN			
DLR-FB–					
90-18	15:49178	NTIS (US Sales Only), PC A08/MF A01		DE90520015	
DOE-RW–					
89.106(v.1)	15:48264	NTIS (US Sales Only), PC A05/MF A01; OSTI; INIS		DE90640167	
89.106(v.2)	15:48265	NTIS (US Sales Only), PC A09/MF A01; OSTI; INIS		DE90640168	
89.106(v.3)	15:48266	NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS		DE90640169	
89.107	15:48267	NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS		DE91602616	
DOE/AL/31950–					
T3	15:48260	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017784	MF-721
DOE/CE/90025–					
2	15:48836	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017288	MF-336
DOE/CE/90029–					
3	15:49179	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016302	MF-363
DOE/CH/10093–					
78	15:48806	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000366	MF-310
DOE/DP/10560–					
7	15:50169	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017515	MF-700
DOE/EA–					
0333	15:48261	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016205	MF-630
0338	15:48262	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016204	MF-630
DOE/EIA–					
0130(90/06)	15:48180	NTIS, PC A08/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90017703	MF-950
0202(90/3Q)	15:48739	NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90017866	MF-950
0534	15:48125	NTIS, PC A07/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90017657	MF-950
M041	15:48740	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017380	MF-950
DOE/ER–					
0454	15:48834	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015964	MF-400
0463P	15:49227	NTIS, PC A14/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90018021	MF-414
0469P	15:48413	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018050	MF-408
DOE/ER/05490–					
112	15:49924	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017403	MF-414

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/ER/13491–					
450	15:49873	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017775	MF-411
DOE/ER/13600–					
T4	15:49153	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017221	MF-404
DOE/ER/13808–					
T1	15:49124	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017447	MF-401
DOE/ER/13846–					
3	15:50091	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017840	MF-405
DOE/ER/13958–					
16	15:49874	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017653	MF-411
DOE/ER/13968–					
T2	15:49643	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017561	MF-408
DOE/ER/14057–					
1	15:49732	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016188	MF-403
DOE/ER/14064–					
1	15:49733	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016187	MF-406
DOE/ER/40231–					
T8	15:49899	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017284	MF-414
DOE/ER/40319–					
3	15:49900	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017336	MF-414
DOE/ER/45328–					
4	15:48869	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017608	MF-404
DOE/ER/45370–					
3	15:48954	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017611	MF-411
DOE/ER/52127–					
72	15:50114	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017774	MF-427
DOE/ER/53198–					
160	15:50115	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90018019	PC-426
DOE/ER/53240–					
3	15:50116	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017605	MF-424
DOE/ER/53297–					
2	15:50117	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017722	MF-421
DOE/ER/60408–					
2	15:49655	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017603	MF-408
DOE/ER/60418–					
2	15:49687	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017602	MF-408
DOE/ER/60438–					
2	15:49688	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017604	MF-408
DOE/ER/60888–					
1-Vol.1	15:48774	NTIS, PC A99/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017786	MF-402
1-Vol.2	15:48775	NTIS, PC A99/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017787	MF-402
1-Vol.3	15:48776	NTIS, PC A99/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017788	MF-402
1-Vol.4	15:48777	NTIS, PC A99/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017789	MF-402
1-Vol.5	15:48778	NTIS, PC A16/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017790	MF-402
DOE/ER/60954–					
1	15:49458	NTIS, PC A15/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017458	MF-403
DOE/ER/75425–					
T1	15:48835	NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017286	MF-406
DOE/ET/53088–					
447	15:50118	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000128	MF-420
450	15:49748	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000148	MF-420
451	15:50119	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017618	MF-420
452	15:49749	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017617	MF-422
DOE/FE–					
197P	15:48501	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018026	PC-101
DOE/ID–					
10287	15:48839	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017089	MF-212
DOE/MA–					
0417P	15:49397	OSTI (Free of Charge)		TI90016694	MF-900
DOE/MC/11076–					
2834	15:48206	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90009667	MF-123
2851	15:48202	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90009663	MF-123
DOE/MC/23077–					
2866	15:48489	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90009678	MF-109
DOE/MC/23270–					
2876	15:48490	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90009697	MF-110
DOE/MC/24207–					
2857	15:48108	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90009672	MF-103
2858	15:48109	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90009671	MF-111; MF-113

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/METC–					
90/6112	15:48760	NTIS, PC A12/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000490	MF-110
DOE/NASA/33408–					
4	15:48469	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017408	MF-236
DOE/NV/10384–					
25	15:49592	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017652	MF-702; MF-706
DOE/OR/00033–					
T439	15:49568	Yale University, New Haven, CT			ND-402
T440	15:48593	Massachusetts Inst. of Tech., Cambridge, MA			ND-505
T441	15:48232	Massachusetts Institute of Technology			ND-513
T442	15:48647	NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017508	MF-523
T444	15:49896	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017510	MF-505
T445	15:50120	NTIS, PC A10/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017511	MF-516
DOE/PC/70507–					
T3	15:48757	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017889	MF-112
DOE/PC/79798–					
T7	15:48502	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017878	MF-105
DOE/PC/79855–					
T1	15:48503	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017290	MF-105
T2	15:48504	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017291	MF-105
T3	15:48505	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017292	MF-105
T4	15:48506	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017293	MF-105
T5	15:48507	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017294	MF-105
T6	15:48508	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017345	MF-105
T7	15:48509	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017346	MF-105
T8	15:48510	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017347	MF-105
T9	15:48511	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017348	MF-105
DOE/PC/79919–					
13	15:48083	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017879	MF-102
DOE/PC/79925–					
7	15:48084	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017888	MF-113
11	15:48085	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000005	MF-113
DOE/PC/80016–					
T9	15:48075	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017887	MF-108
DOE/PC/88800–					
26	15:48076	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016792	MF-108
DOE/PC/88802–					
T5	15:48077	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017248	MF-108
DOE/PC/88889–					
T5	15:48512	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016758	MF-105
DOE/PC/88923–					
T2	15:48086	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017893	MF-113
DOE/PC/88951–					
5	15:48210	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017259	MF-114
6	15:48211	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017258	MF-114
DOE/PC/89651–					
T1	15:48513	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015424	MF-105
DOE/PC/89769–					
T2	15:48111	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017877	MF-106
DOE/PC/89909–					
T1	15:48072	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017895	MF-113
DOE/PC/90014–					
T7	15:48078	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017621	MF-108
DOE/PC/90274–					
T8	15:48758	NTIS, PC A12/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017886	MF-112
DOE/PC/90505–					
T5	15:48112	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017891	MF-104
T6	15:48113	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017890	MF-104
DOE/PC/90514–					
T10	15:48093	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017875	MF-113
DOE/PC/91257–					
T6	15:48079	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017892	MF-102
DOE/PE–					
0095P	15:48845	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014847	PC-334
DOE/RL–					
90-17	15:48263	NTIS, PC A99/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017726	MF-510
90-34	15:48618	NTIS, PC A12/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017725	MF-630
DOE/RW–					
0207	15:48268	Free from OSTI			MF-814

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/SF/16306–					
23	15:48472	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017273	MF-231
DRES-SM–					
1331	15:49409	*See* AD-A-222809/6/XAB			
DTP–					
90-24	15:49957	*See* RAL–90-030			
E–					
1308/R001	15:49198	*See* OTO–89-005			
5250	15:48969	*See* N–90-24382			
5381	15:48967	*See* N–90-23754			
5528	15:48459	*See* N–90-23662			
5537	15:49193	*See* N–90-24349			
5554	15:49192	*See* N–90-23591			
5555	15:49156	*See* N–90-23518			
5580	15:48852	*See* N–90-23773			
EDF-DER-RA–					
1989-2	15:48736	NTIS (US Sales Only), PC A07/MF A01		DE91701174	
EFI–					
1000(50)-87	15:49289	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602565	
1008(58)-87	15:49244	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602287	
1013(63)-87	15:49231	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602257	
1017(67)-87	15:49290	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602548	
1018(68)-87	15:49245	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602315	
1021(71)-87	15:49246	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602294	
1022(72)-87	15:49291	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602566	
1025(75)-87	15:49247	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602295	
1035(85)-87	15:49248	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602288	
1045(8)-88	15:49292	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602567	
90-33	15:49820	*See* N–90-24123			
988(38)-87	15:49243	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602316	
995(45)-87	15:49288	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602549	
EGG–					
2602	15:48667	*See* NUREG/CR–5575			
EGG-M–					
90041	15:49154	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90010929	MF-506
90064	15:48870	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90012964	MF-501
90067	15:49180	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90013099	MF-310
90249	15:48572	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90013092	MF-522
EI–					
90-03390	15:48779	PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
EM–					
92	15:48955	PC Ontario Ministry of Transportation, Engineering Materials Office, 1201 Wilson Ave., Central Bldg., Downsview, ON, CAN M3M 1J8; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
EMR–					
90-02761	15:48766	PC Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
EPA–					
450/3-90/016A	15:49540	*See* PB–90-252495/XAB			
530/SW-90/061A	15:49577	*See* PB–90-234485/XAB			
530/SW-90/061B	15:49516	*See* PB–90-234493/XAB			
530/SW-90/061C	15:49517	*See* PB–90-234501/XAB			
530/SW-90/061D	15:49607	*See* PB–90-234519/XAB			
530/SW-90/061E	15:49518	*See* PB–90-234527/XAB			
530/SW-90/061F	15:49519	*See* PB–90-234535/XAB			
530/SW-90/061G	15:49520	*See* PB–90-234543/XAB			
530/SW-90/061H	15:49521	*See* PB–90-234550/XAB			
530/SW-90/061I	15:49522	*See* PB–90-234568/XAB			
530/SW-90/061J	15:49523	*See* PB–90-234576/XAB			
530/SW-90/061K	15:49524	*See* PB–90-234584/XAB			
530/SW-90/061L	15:49525	*See* PB–90-234592/XAB			
530/SW-90/061M	15:49526	*See* PB–90-234600/XAB			
530/SW-90/061N	15:49608	*See* PB–90-234618/XAB			
530/SW-90/061O	15:49527	*See* PB–90-234626/XAB			
530/SW-90/061P	15:49528	*See* PB–90-234634/XAB			
530/SW-90/061Q	15:48147	*See* PB–90-234642/XAB			
530/SW-90/061R	15:49529	*See* PB–90-234659/XAB			
530/SW-90/061S	15:49530	*See* PB–90-234667/XAB			
530/SW-90/062A	15:49578	*See* PB–90-234683/XAB			
530/SW-90/062B	15:49579	*See* PB–90-234691/XAB			
530/SW-90/062C	15:49609	*See* PB–90-234709/XAB			
9200.5-001	15:48706	*See* PB–90-249491/XAB			
9240.0-03	15:48707	*See* PB–90-249541/XAB			
9260.1-09	15:49580	*See* PB–90-249566/XAB			
9260.3-00	15:48157	*See* PB–90-249574/XAB			
9260.5-01	15:49581	*See* PB–90-249582/XAB			
9330.2-04	15:49612	*See* PB–90-249616/XAB			
9355.3-05	15:48709	*See* PB–90-249657/XAB			
9355.3-09	15:48710	*See* PB–90-249681/XAB			
9360.0-21	15:48158	*See* PB–90-249715/XAB			
9375.5-04	15:48711	*See* PB–90-249731/XAB			
9380.4-01	15:48159	*See* PB–90-249798/XAB			
EPA/AA/TSS/IM–					
87/2	15:48160	*See* PB–90-250127/XAB			
EPA/ROD/R–					
01-90/045	15:49628	*See* PB–90-254293/XAB			
03-90/085	15:49629	*See* PB–90-254301/XAB			
03-90/086	15:49630	*See* PB–90-254319/XAB			
EPA/ROD/RO–					
2-90/100	15:49631	*See* PB–90-254335/XAB			
EPRI-CS–					
3612-Vol.1-Rev.1	15:48514	Research Reports Center, Box 50490, Palo Alto, CA 94303			
EPRI-CU–					
6924-Vol.2	15:48749	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6964	15:48750	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6969	15:48780	Research Reports Center, Box 50490, Palo Alto, CA 94303			
EPRI-EL–					
6965	15:48674	Research Reports Center, Box 50490, Palo Alto, CA 94303			
EPRI-GS–					
6976	15:48601	Research Reports Center, Box 50490, Palo Alto, CA 94303			
EPRI-NP–					
6480-Vol.11	15:48665	*See* NUREG/CR–5395-Vol.11			
6480-Vol.11-Add.	15:48666	*See* NUREG/CR–5395-Vol.11-Add.			
6516	15:48602	Research Reports Center, Box 50490, Palo Alto, CA 94303			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
EPRI-NP–					
6927-D	15:48528	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6934	15:48269	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6940	15:48233	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-812
6954	15:48529	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6956-D	15:48530	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6975-D	15:48544	Research Reports Center, Box 50490, Palo Alto, CA 94303			
ERI–					
89279	15:48115	*See* IS-M–648			
89282	15:48114	*See* IS-M–647			
ESA-SP–					
290	15:49750	NTIS (US Sales Only), PC A99/MF A01		DE91702111	
ESRF–					
90-03338	15:48747	PC Canada Oil and Gas Lands Administration, 355 River Rd., 15th Floor, Tower B, Ottawa, Ont., CAN K1A 0E4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
ESTD-L–					
0104/R89	15:48993	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601346	
0108/R89	15:48545	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602442	
ETDE/PUB–					
2	15:50249	NTIS, PC A99/MF A01 - OSTI		DE90008750	
EUR–					
11888	15:48807	NTIS (US Sales Only), PC A19/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 37.50		TI90016060	
12046	15:48808	NTIS (US Sales Only), PC A17/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 35		TI90016455	
12097	15:48145	NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 5		TI90016068	
12099	15:48828	NTIS (US Sales Only), PC A04/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 5		TI90016454	
12110	15:48473	NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 5		TI90016451	
12166	15:48829	NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 5		TI90016075	
12216	15:48270	NTIS (US Sales Only), PC A04/MF A01			
12229	15:49734	NTIS (US Sales Only), PC A03/MF A01			
12235	15:48137	NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg		TI90017778	
12246	15:48809	NTIS (US Sales Only), PC A13/MF A01; OSTI; Office of Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 25		TI90016082	
12269	15:48648	NTIS (US Sales Only), PC A11/MF A01			
12273	15:48649	NTIS (US Sales Only), PC A05/MF A01			
12276	15:48650	NTIS (US Sales Only), PC A05/MF A01			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
12289	15:48810	NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg		TI90016076	
12290	15:48271	NTIS (US Sales Only), PC A06/MF A01			
12297	15:48272	NTIS (US Sales Only), PC A10/MF A01			
12299	15:48273	NTIS (US Sales Only), PC A03/MF A01			
12303	15:48274	NTIS (US Sales Only), PC A08/MF A01			
12342	15:48275	NTIS (US Sales Only), PC A04/MF A01			
12375	15:48619	NTIS (US Sales Only), PC A04/MF A01			
12380	15:48215	NTIS (US Sales Only), PC A04/MF A01			
12381	15:48276	NTIS (US Sales Only), PC A03/MF A01			
12383	15:48277	NTIS (US Sales Only), PC A04/MF A01			
12388	15:48871	NTIS (US Sales Only), PC A06/MF A01			
12401	15:48278	NTIS (US Sales Only), PC A03/MF A01			
12402	15:48872	NTIS (US Sales Only), PC A06/MF A01			
12438	15:48994	NTIS (US Sales Only), PC A03/MF A01			
12466	15:48761	NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg		TI90017779	
12480	15:48435	NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg		TI90017780	
12489	15:48279	NTIS (US Sales Only), PC A04/MF A01			
12490	15:48651	NTIS (US Sales Only), PC A05/MF A01			
12499	15:48280	NTIS (US Sales Only), PC A05/MF A01			
12517	15:48411	NTIS (US Sales Only), PC A09/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 15		TI90017781	
12522	15:48621	NTIS (US Sales Only), PC A18/MF A01			
12525	15:48532	NTIS (US Sales Only), PC A04/MF A01			
12533	15:48781	NTIS (US Sales Only), PC A04/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg		TI90017782	
12570	15:48281	NTIS (US Sales Only), PC A05/MF A01			
EUR-CEA-FC–					
1359	15:50121	NTIS (US Sales Only), PC A03/MF A01			
FEI–					
1917	15:49981	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601229	
1942	15:48594	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602378	
1946	15:49228	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602252	
1950	15:49249	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602289	
1958	15:50025	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601123	
FERIC–					
HB07	15:48412	Forest Engineering Research Institute of Canada, 143 Place Frontenac, Pointe Claire, PQ, CAN H9R 4Z7. Prices: $27.00 CAN			
FERMILAB-PUB–					
90/114-A	15:50048	*See* N–90-24121			
90/119-A	15:49823	*See* N–90-24214			
90/49-A	15:49820	*See* N–90-24123			
90/77-A	15:49821	*See* N–90-24211			
90/89-A	15:49819	*See* N–90-24122			
90/97-A	15:49822	*See* N–90-24213			
FERMILAB-PUBL–					
90/81-A	15:49824	*See* N–90-24881			
FJSRL-TR–					
90-0001	15:48691	*See* AD-A–223097/7/XAB			
FNAL-TM–					
1674	15:49250	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017498	PC-406
1676	15:49251	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018049	PC-406
1678	15:49252	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018048	PC-406

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
FNAL-TM–					
1679	15:50216	NTIS, PC A03/MF A01 - OSTI		DE90018018	PC-405
FRCEA-TH–					
209	15:49232	NTIS (US Sales Only), PC A07/MF A01		DE91700556	
283	15:49906	NTIS (US Sales Only), PC A09/MF A01		DE91702090	
288	15:49982	NTIS (US Sales Only), PC A11/MF A01		DE91702152	
289	15:48873	NTIS (US Sales Only), PC A07/MF A01		DE91702102	
292	15:49998	NTIS (US Sales Only), PC A05/MF A01		DE91702093	
FRNC-R–					
161	15:48446	NTIS (US Sales Only), PC A04/MF A01		DE91701148	
322	15:50008	NTIS (US Sales Only), PC A03/MF A01		DE91702099	
FRNC-TH–					
3538	15:50092	NTIS (US Sales Only), PC A08/MF A01		DE91700560	
3645	15:48811	NTIS (US Sales Only), PC A07/MF A01		DE91701159	
FSRP/INT–					
424	15:48437	*See* PB–90-251992/XAB			
FSU-HEP–					
041090	15:49293	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017337	MF-414
881011	15:49907	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017449	MF-414
890130	15:49908	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017318	MF-414
FTD-ID(RS)T–					
0202-88	15:48124	*See* AD-A–222910/2/XAB			
0923-88	15:48856	*See* AD-A–222960/7/XAB			
FWS/OBS–					
80/23	15:48149	OSTI; US Fish and Wildlife Services, Division of Biological Services, US Dept. Of The Interior, Washington, DC 20240		TI90017626	
81/03	15:49593	OSTI; U.S. Fish and Wildlife Service, NASA-Slidell Computer Complex, 1010 Gause Blvd., Slidell, LA 70458		TI90017625	
82/15	15:49569	OSTI; U.S. Fish and Wildlife Service, NASA-Slidell Computer Complex, 2020 Gause Blvd., Slidell, LA 70458		TI90017622	
82/16	15:49570	OSTI; U.S. Fish and Wildlife Service, NASA-Slidell Computer Complex, 1010 Gause Blvd., Slidell, LA 70458		TI90017623	
82/45	15:49571	OSTI; US Fish and Wildlife Service, NASA-Slidell Computer Complex, 1010 Gause Blvd., Slidell, LA 70458		TI90017624	
GA-A–					
20115	15:48573	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017588	MF-522
GANIL-P–					
8921	15:50012	NTIS (US Sales Only), PC A03/MF A01		DE91702098	
GL-TR–					
90-0139	15:49852	*See* AD-A–222580/3/XAB			
90-0144	15:49857	*See* AD-A–223198/3/XAB			
GRI–					
90/0166	15:48177	*See* PB–90-247412/XAB			
90/0181	15:48178	*See* PB–90-252545/XAB			
GSC–					
90-1F	15:49735	PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
Bull-390	15:49736	PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $18.00 CAN; MF $10 CAN			
GSF-HY–					
38/88	15:49594	NTIS (US Sales Only), PC A12/MF A01		DE90519861	
HEPI–					
88-17	15:49909	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601103	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
HME–					
90-03778	15:48782	PC Canada Mortgage and Housing Corporation, Annex Bldg., 682 Montreal Rd., Ottawa, ON, CAN K1A 0P7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
HW–					
72042	15:48225	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015354	MF-711
HWC/HP–					
H46-2/89-150E	15:49727	PC Health and Welfare Canada, Communications Directorate, Brooke Claxton Bldg, Ottawa, ON, CAN K1A 0K9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
IAE–					
4647-3	15:48603	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602383	
4691-4	15:48595	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602379	
4702-16	15:50174	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600903	
4727-1	15:50070	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91600711	
4740-6	15:50122	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91600854	
4741-4	15:49294	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602537	
4754-6	15:49875	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600608	
4756-6	15:50123	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600855	
4757-1	15:50093	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91600481	
4761-2	15:50026	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601158	
4762-2	15:50027	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601219	
4767-6	15:50124	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600765	
4774-5	15:50054	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601115	
4775-8	15:50125	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600764	
4784-7	15:50126	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600815	
4785-7	15:50127	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600816	
4787-8	15:50128	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91600844	
4792-8	15:50175	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600901	
4797-4	15:48596	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602380	
4827-6	15:50129	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600766	
4828-6	15:49809	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91600990	
4833-2	15:49897	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601023	
4838-7	15:50130	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600817	
4840-1	15:49810	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91600932	
4848-16	15:50131	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600845	
4849-14	15:49295	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602538	
4853-16	15:50176	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600899	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
4869-2	15:50016	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601302	
4876-2	15:50028	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601220	
4904-1	15:49925	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601048	
IAEA-CN–					
53/C-2-2-(2)	15:50115	*See* DOE/ER/53198–160			
53/C-3-4	15:50112	*See* CONF-901025–6			
53/C-4-7	15:50132	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017734	MF-421
IAEA-INFCIRC–					
209(Mod.2/Add.3)	15:48396	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602644	
209(Mod.3/Add.3)	15:48397	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602645	
209(Mod.4/Add.1)	15:48398	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602646	
278(Corr.1)	15:48389	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602673	
376	15:48390	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602674	
378	15:48847	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602675	
380	15:49398	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602654	
381	15:48391	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602676	
382	15:48848	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602677	
383	15:48652	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601970	
IAEA-NDS–					
0(Rev.90/1)	15:50250	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602680	
114(Rev.0)	15:49986	NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS		DE91601230	
116(Rev.0)	15:49987	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601232	
23(Rev.3)	15:50252	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602681	
51(Rev.2)	15:49983	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601233	
7(Rev.90/1)	15:50251	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602682	
90(Rev.2)	15:49984	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601234	
96(Rev.0)	15:49985	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601235	
IAEA-R–					
4297-F	15:49712	NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS		DE90636742	
IAEA-TC–					
560.03	15:48653	NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS		DE91602443	
IAEA-TECDOC–					
555	15:48242	NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS		DE91602626	
IEPA/WPC–					
90-160	15:49618	*See* PB–90-252396/XAB			
IFP–					
37748-1	15:48697	NTIS (US Sales Only), PC A16/MF A01		DE91701169	
IFSR–					
447	15:50118	*See* DOE/ET/53088–447			
450	15:49748	*See* DOE/ET/53088–450			
451	15:50119	*See* DOE/ET/53088–451			
452	15:49749	*See* DOE/ET/53088–452			
IFUSP-P–					
800	15:50094	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91600482	
814	15:49926	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601028	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
827	15:50071	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600636	
834	15:49964	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600516	
836	15:50095	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600483	
837	15:49958	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91600566	
838	15:49959	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600567	
839	15:50055	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601118	
842	15:49965	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600517	
IFVE-OEF–					
89-102	15:49365	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602608	
89-103	15:49297	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602550	
89-105	15:49298	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602551	
89-131	15:49299	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602552	
89-56(E-581/E-704)	15:49278	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602363	
89-95	15:49910	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601108	
89-99	15:49296	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602553	
IFVE-OLU–					
89-126	15:49255	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602317	
89-86	15:49253	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602296	
89-97	15:49254	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602297	
IFVE-OMVT–					
89-104	15:49256	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602298	
89-42	15:49378	NTIS (US Sales Only), PC A05/MF A01; OSTI; INIS		DE91602597	
IFVE-ONF–					
89-135	15:49300	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602554	
89-93	15:49927	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601049	
89-94	15:49928	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601029	
IFVE-OP–					
89-127	15:49383	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602598	
89-129	15:50217	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602599	
IFVE-ORI–					
89-123	15:49301	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602533	
IFVE-OTF–					
88-147	15:49966	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600518	
88-148	15:49929	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601050	
89-110	15:49933	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601051	
89-111	15:49934	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601052	
89-136	15:49935	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601025	
89-140	15:49936	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601053	
89-144	15:49937	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601054	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
IFVE-OTF–					
89-66	15:49930	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601055	
89-75	15:49931	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601056	
89-80	15:50096	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91600477	
89-87	15:49932	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601057	
89-88	15:49911	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601104	
IFVE-OUNK–					
89-114	15:49181	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91600999	
IKE–					
5-230	15:48874	NTIS (US Sales Only), PC A06/MF A01		DE90519897	
IL–					
90-9	15:48186	Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4. Prices: $5.00 CAN			
INDC(CCP)–					
312	15:50009	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601267	
313	15:49999	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601252	
314	15:50056	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601116	
INIS-mf–					
12110	15:49690	NTIS (US Sales Only), PC A04/MF A01 - OSTI		DE90706210	
12113	15:49691	NTIS (US Sales Only), PC A05/MF A01 - OSTI		DE90706212	
12114	15:49692	NTIS (US Sales Only), PC A05/MF A01 - OSTI		DE90706211	
INS–					
816	15:50029	NTIS (US Sales Only), PC A02/MF A01		DE90520206	
818	15:50004	NTIS (US Sales Only), PC A02/MF A01		DE90520225	
819	15:49938	NTIS (US Sales Only), PC A03/MF A01		DE90520226	
820	15:50072	NTIS (US Sales Only), PC A02/MF A01		DE90520227	
821	15:49939	NTIS (US Sales Only), PC A03/MF A01		DE90520260	
822	15:50030	NTIS (US Sales Only), PC A03/MF A01		DE90520259	
823	15:49996	NTIS (US Sales Only), PC A03/MF A01		DE90520258	
826	15:48917	NTIS (US Sales Only), PC A04/MF A01		DE90520336	
828	15:50031	NTIS (US Sales Only), PC A03/MF A01		DE90520335	
INS-T–					
496	15:50218	NTIS (US Sales Only), PC A03/MF A01		DE90520261	
IPEN-PUB–					
129	15:48875	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601550	
172	15:48561	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602463	
174	15:49713	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90639714	
286	15:49148	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601444	
294	15:49693	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602119	
IPNO-DRE–					
89-21	15:49995	NTIS (US Sales Only), PC A02/MF A01		DE91700538	
89-25	15:50073	NTIS (US Sales Only), PC A03/MF A01		DE91700562	
IPPCZ–					
293/III	15:50133	NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS		DE91600824	
IS–					
4992	15:48876	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017231	MF-404
5009	15:48087	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017732	MF-102
IS-IPRT–					
5	15:49737	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017513	
6	15:49738	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017514	
IS-M–					
618	15:48995	NTIS, PC A03/MF A01; OSTI; INIS		DE90016699	PC-501
619	15:48654	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016700	PC-506
620	15:49034	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016701	PC-401
623	15:48877	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016704	PC-404
625	15:48094	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017426	PC-107

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
627	15:49189	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017252	PC-404
628	15:48095	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016706	PC-107
629	15:48088	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016707	PC-102
630	15:48918	NTIS, PC A02/MF A01 - OSTI		DE90016708	PC-404
631	15:48919	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016709	PC-404
632	15:48920	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016710	PC-404
633	15:48921	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016711	PC-404
634	15:50074	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016712	PC-410
635	15:48956	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016713	PC-504
636	15:48996	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017253	PC-404
637	15:48878	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018045	PC-404
638	15:48879	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018040	PC-404
639	15:50075	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90018044	PC-411
640	15:50076	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90018042	PC-411
641	15:48922	NTIS, PC A02/MF A01 - OSTI		DE90018013	PC-404
642	15:48923	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90018014	PC-411
643	15:50097	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018046	PC-405
644	15:48104	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018039	PC-101
645	15:48957	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018043	PC-404
646	15:48880	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018041	PC-404
647	15:48114	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018015	PC-103
648	15:48115	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018016	PC-103
649	15:48089	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018017	PC-102
650	15:48116	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018022	PC-103
IS-T–					
1474	15:48881	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000196	MF-404
1488	15:49912	Iowa State University, Ames, IA 50011			ND-414
1489	15:48924	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017656	MF-404
ISAS-SP–					
10	15:49811	NTIS (US Sales Only), PC A06/MF A01		DE90520427	
ISI/SR–					
89-235	15:50209	*See* AD-A–222466/5/XAB			
ITEF–					
102-89	15:49257	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602329	
110-89	15:49233	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602268	
138-88	15:49988	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601237	
164-88	15:48597	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602381	
169-88	15:49234	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602269	
38-89	15:48627	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602523	
39-89	15:48628	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602524	
40-89	15:48629	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602525	
58-89	15:49303	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602539	
77-89	15:49304	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602555	
78-89	15:50150	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600803	
87-89	15:50177	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600904	
88-89	15:50219	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602685	
89-89	15:50178	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600905	
93-89	15:50098	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600486	
96-89	15:49997	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601248	
ITEP–					
121-88	15:49940	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601059	
131-88	15:49941	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601060	
144-88	15:50032	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601160	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
ITEP–					
152-88	15:49942	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601061	
156-88	15:49258	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602303	
ITF–					
88-104	15:49943	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601062	
88-110	15:50151	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600864	
88-111	15:49967	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600520	
88-127	15:48925	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601677	
88-145	15:49944	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601030	
88-146	15:50152	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600865	
88-157	15:50153	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600866	
88-174	15:49813	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600962	
88-176	15:49968	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600521	
88-86	15:49812	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600926	
89-2	15:50154	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600804	
ITP–					
88-116	15:49945	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601038	
88-117	15:49946	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601063	
88-126	15:49947	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601098	
88-156	15:49969	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600522	
88-158	15:50033	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601161	
88-167	15:49814	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600963	
88-168	15:49815	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600964	
88-175	15:49948	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601064	
89-3	15:50034	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601162	
89-4	15:49816	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600933	
IWGRRPC–					
88-2	15:48520	NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS		DE91602421	
IYF–					
88-01/A	15:49989	NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS		DE91601238	
88-03	15:49990	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601239	
IYaF–					
88-104	15:49208	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602603	
88-22	15:49207	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602604	
88-23	15:50220	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602686	
88-93	15:49384	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602605	
89-49	15:50077	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600641	
JA–					
6345	15:49202	*See* AD-A-222720/5/XAB			
JAERI-M–					
90-061	15:48882	NTIS (US Sales Only), PC A03/MF A01		DE90520207	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
90-062	15:48997	NTIS (US Sales Only), PC A04/MF A01		DE90520208	
90-063	15:48630	NTIS (US Sales Only), PC A03/MF A01		DE90520209	
90-064	15:49162	NTIS (US Sales Only), PC A03/MF A01		DE90520210	
90-065	15:49572	NTIS (US Sales Only), PC A03/MF A01		DE90520224	
90-066	15:50155	NTIS (US Sales Only), PC A14/MF A01		DE90520221	
90-067	15:48583	NTIS (US Sales Only), PC A05/MF A01		DE90520211	
90-068	15:50221	NTIS (US Sales Only), PC A04/MF A01		DE90520265	
90-070	15:48655	NTIS (US Sales Only), PC A03/MF A01		DE90520212	
90-071	15:48575	NTIS (US Sales Only), PC A04/MF A01		DE90520223	
90-072	15:49259	NTIS (US Sales Only), PC A04/MF A01		DE90520213	
90-073	15:48656	NTIS (US Sales Only), PC A08/MF A01		DE90520220	
90-074	15:48392	NTIS (US Sales Only), PC A07/MF A01		DE90520222	
90-075	15:48283	NTIS (US Sales Only), PC A04/MF A01		DE90520331	
90-076	15:49714	NTIS (US Sales Only), PC A03/MF A01		DE90520219	
90-077	15:49279	NTIS (US Sales Only), PC A03/MF A01		DE90520218	
90-079	15:48631	NTIS (US Sales Only), PC A03/MF A01		DE90520262	
90-080	15:48657	NTIS (US Sales Only), PC A06/MF A01		DE90520264	
90-081	15:50156	NTIS (US Sales Only), PC A03/MF A01		DE90520263	
90-082	15:48576	NTIS (US Sales Only), PC A03/MF A01		DE90520333	
90-084	15:49149	NTIS (US Sales Only), PC A03/MF A01		DE90520332	
JINR–					
13-89-164	15:49305	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602541	
14-89-462	15:50078	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600712	
2-35-89	15:49745	NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS		DE90706214	
9-89-118	15:49229	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602254	
JINR-E–					
1-89-291	15:49260	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602330	
12-89-162	15:48958	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601716	
14-89-128	15:50079	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91600642	
16-89-59	15:49261	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602331	
2-89-145	15:49949	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601031	
2-89-37	15:50038	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601163	
2-89-39	15:49970	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91600523	
4-89-165	15:50040	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601124	
4-89-19	15:49971	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91600524	
4-89-211	15:50041	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601125	
4-89-51	15:50039	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601126	
7-89-126	15:49991	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601240	
JINR-R–					
1-89-206	15:49307	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602556	
1-89-47	15:50042	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601164	
1-89-64	15:49950	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601065	
1-89-87	15:49306	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602557	
11-89-188	15:50101	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600487	
13-89-115	15:49308	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602540	
2-88-940	15:49972	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600525	
2-89-182	15:50099	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600504	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
JINR-R–					
2-89-224	15:50100	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91600505	
2-89-86	15:49951	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601066	
6-89-190	15:49150	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601445	
JOY-LT–					
16	15:49599	Joensuu Univ, Finland			
K/CSD/INF–					
89/42/R1	15:48883	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017702	MF-701
K/ETO–					
34	15:48216	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000134	MF-501
KAPL–					
4718	15:48658	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016661	PC-506
KCP–					
613-4118	15:50222	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000060	PC-706
613-4404	15:49209	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017647	MF-701
KEK-PR–					
89-3	15:50203	NTIS (US Sales Only), PC A19/MF A01		DE90520234	
KFK–					
4716	15:48096	NTIS (US Sales Only), PC A03/MF A01		DE90519796	
KFTI–					
88-19	15:49235	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602270	
88-21	15:50157	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600867	
88-22	15:49879	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91600611	
88-26	15:50158	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600805	
88-27	15:48959	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601717	
88-33	15:48884	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601512	
88-34	15:50179	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91600900	
88-35	15:50159	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91600868	
88-36	15:50102	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91600488	
88-38	15:48926	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91601671	
88-41	15:48885	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601513	
88-46	15:50160	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91600856	
KIFVE–					
87-19	15:50043	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601167	
88-08	15:49901	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90706215	
88-09	15:50080	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90706213	
88-12	15:50047	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601171	
88-15	15:49956	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601068	
88-16	15:49992	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601241	
KMSF-U–					
2205	15:50169	*See* DOE/DP/10560–7			
L–					
16669	15:48467	*See* N–90-24585			
16759	15:49716	*See* N–90-25031			
16785	15:48853	*See* N–90-24350			
LA–					
11671-MS	15:48284	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90018028	MF-510
11849-MS	15:49739	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018027	MF-403
11882-MS	15:49817	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017854	MF-900
11884-MS	15:48998	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018038	PC-704
11895-MS	15:48886	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017855	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
11907-MS	15:49392	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018047	PC-741
11915-MS	15:50084	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018023	MF-700
LA-UR–					
90-1548	15:49651	NTIS, PC A02/MF A01 - OSTI		DE90012097	MF-908
90-1641	15:48577	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90011973	
90-1833	15:48659	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90012059	
90-1845	15:50103	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90012000	MF-705
90-2055	15:49993	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90013168	MF-413
90-2164	15:48408	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90013151	MF-528
90-2212	15:49994	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015104	MF-413
90-2308	15:49385	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015031	MF-906
90-2514	15:50060	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014896	MF-705
90-2562	15:49704	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015057	MF-908
90-2564	15:50224	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015058	MF-905
90-2571	15:49740	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014979	MF-903; MF-905
90-2577	15:50225	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015060	MF-905
90-2637	15:50254	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016719	MF-900
90-2638	15:49898	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016718	MF-910
90-2777	15:48660	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016492	
90-2828	15:48887	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016487	MF-904
90-2856	15:49644	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016446	MF-406
90-3255	15:50000	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000214	MF-413
LAL–					
8935	15:49915	NTIS (US Sales Only), PC A02/MF A01		DE91702100	
LBL–					
22702	15:48751	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017899	MF-350
27358	15:48932	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014508	MF-404
28189	15:49236	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000249	MF-414
28197	15:48783	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016619	PC-350
28268	15:48784	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016281	MF-350
29361	15:50001	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91000180	MF-413
LPC–					
90-04108	15:48675	PC New Brunswick Legislative Library, Government Documents Section, 766 King St, Fredericton, NB, CAN E3B 5H1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
LRU/C–					
23440M7M9133/01MSS	15:48841	PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
LTKK-EN–					
B65	15:48492	Lappenrannan Teknillinen Korkeakoulu, Finland, Energratekniikan Laitos			
C48	15:49463	Lapperannan Teknillinen Korkeakoulu, Finland, Energratekniiken Laitos			
MAE–					
90-03908	15:48752	PC Maritime Electric Co. Ltd., Confederation Court Mall, 134 Kent St., Charlottetown, PE, CAN C1A 7N2; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
MD-QA–					
052	15:48903	*See* AD-A–222853/4/XAB			
MECH–					
159	15:48904	*See* AD-A–222931/8/XAB			
MHD-ITC–					
90-133	15:48758	*See* DOE/PC/90274–T8			
MIC–					
90-03090/XAB	15:48170	NTIS, PC EE07/MF E01			
90-03097/XAB	15:48703	NTIS, PC EE07/MF E01			
90-03115/XAB	15:48171	NTIS, PC EE07/MF E01			
90-03118/XAB	15:48704	NTIS, PC EE12/MF E01			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
90-03187/XAB	15:48130	NTIS, PC EE07/MF E01			
90-03188/XAB	15:48679	NTIS, PC EE07/MF E01			
90-03189/XAB	15:48680	NTIS, PC EE07/MF E01			
90-03191/XAB	15:48199	NTIS, PC EE12/MF E01			
90-03198/XAB	15:49464	NTIS, PC EE07/MF E01			
90-03223/XAB	15:49600	NTIS, PC EE12/MF E01			
90-03228/XAB	15:49601	NTIS, PC EE12/MF E01			
90-03267/XAB	15:48098	NTIS, PC EE12/MF E01			
90-03274/XAB	15:49465	NTISMF E01			
90-03278/XAB	15:48515	NTIS, PC EE17/MF E01			
90-03279/XAB	15:48099	NTIS, PC EE12/MF E01			
90-03290/XAB	15:48150	NTIS, PC EE07/MF E01			
90-03314/XAB	15:48744	NTIS, PC EE07/MF E01			
90-03330/XAB	15:48151	NTIS, PC EE07/MF E01			
90-03376/XAB	15:48189	NTIS, PC EE07/MF E01			
90-03377/XAB	15:48101	NTIS, PC EE07/MF E01			
90-03380/XAB	15:48102	NTIS, PC EE17/MF E01			
90-03381/XAB	15:48123	NTIS, PC EE07/MF E01			
90-03383/XAB	15:48173	NTIS, PC EE07/MF E01			
90-03390/XAB	15:48688	NTIS, PC EE07/MF E01			
90-03392/XAB	15:48100	NTIS, PC EE12/MF E01			
90-03394/XAB	15:48152	NTISMF E01			
90-03410/XAB	15:49399	NTIS, PC EE07/MF E01			
90-03501/XAB	15:48132	NTIS, PC EE17/MF E01			
90-03515/XAB	15:48234	NTIS, PC EE07/MF E01			
90-03516/XAB	15:48285	NTIS, PC EE07/MF E01			
90-03519/XAB	15:48399	NTIS, PC EE07/MF E01			
90-03527/XAB	15:48400	NTIS, PC EE17/MF E01			
90-03528/XAB	15:48661	NTIS, PC EE07/MF E01			
90-03529/XAB	15:48516	NTIS, PC EE07/MF E01			
90-03531/XAB	15:48493	NTIS, PC EE07/MF E01			
90-03532/XAB	15:49466	NTIS, PC EE12/MF E01			
90-03534/XAB	15:48286	NTIS, PC EE12/MF E01			
90-03535/XAB	15:48235	NTIS, PC EE07/MF E01			
90-03579/XAB	15:49602	NTIS, PC EE12/MF E01			
90-03612/XAB	15:48080	NTIS, PC EE07/MF E01			
90-03615/XAB	15:49715	NTIS, PC EE07/MF E01			
90-03619/XAB	15:49728	NTIS, PC EE07/MF E01			
90-03624/XAB	15:49718	NTIS, PC EE07/MF E01			
90-03742/XAB	15:49467	NTIS, PC EE07/MF E01			
90-03744/XAB	15:48141	NTISMF E01			
MICROLOG–					
87-02413	15:48748	*See* NSME–87-02413			
89-02659	15:48734	*See* RRTAC–88-6			
89-05826	15:48144	*See* SASKOIL–89-05826			
90-00338	15:48181	*See* MPUB–90-00338			
90-01413	15:48842	*See* CRFA–90-01413			
90-01788	15:49634	*See* QMLCP/SAEF–90-01788			
90-02589	15:48743	*See* QMER/BEEN–90-02589			
90-02603	15:48518	*See* NSP–90-02603			
90-02761	15:48766	*See* EMR–90-02761			
90-02857	15:49576	*See* OWMC–1887-01			
90-02879	15:49455	*See* ARC–90-02879			
90-02942	15:48143	*See* PMA–90-02942			
90-02989	15:49736	*See* GSC–Bull-390			
90-03188	15:48681	*See* NBE–90-03188			
90-03189	15:48682	*See* NBE–90-03189			
90-03281	15:49413	*See* RRTAC–89-2-Vol.1			
90-03290	15:48165	*See* TP–208			
90-03302	15:48169	*See* CPA/PD–90-03302			
90-03314	15:48745	*See* NBNRE–90-03314			
90-03338	15:48747	*See* ESRF–90-03338			
90-03381	15:48841	*See* LRU/C–23440M7M9133/01MSS			
90-03383	15:48174	*See* NDA/NF–90-03383			
90-03390	15:48779	*See* EI–90-03390			
90-03394	15:48153	*See* MOC–90-03394			
90-03413	15:48753	*See* MPUB–43/90			
90-03425	15:48830	*See* MRAC–90-03425			
90-03431	15:49414	*See* RRTAC–89-2-Vol.2			
90-03451	15:48728	*See* SEM–90-03451			
90-03517	15:48453	*See* OH/RD–89-173-K			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
90-03518	15:48450	*See* OH/RD–89-235-K			
90-03520	15:48676	*See* OH/RD–89-252-K			
90-03521	15:49729	*See* OH/RD–89-259-K			
90-03522	15:48689	*See* OH/RD–89-274-K			
90-03524	15:48786	*See* OH/RD–89-231-K			
90-03525	15:48970	*See* OH/RD–89-261-K			
90-03526	15:49186	*See* OH/RD–89-230-K			
90-03530	15:48677	*See* OH/RD–89-275-K			
90-03531	15:48494	*See* OH/RD–89-232-K			
90-03532	15:49472	*See* OH/RD–89-262-K			
90-03552	15:49735	*See* GSC–90-1F			
90-03625	15:48733	*See* OE/RT–90-03626-Vol.2			
90-03744	15:48139	*See* CERI–34			
90-03778	15:48782	*See* HME–90-03778			
90-03856	15:49727	*See* HWC/HP–H46-2/89-150E			
90-03908	15:48752	*See* MAE–90-03908			
90-03936	15:48812	*See* OAF/AED–89-6508			
90-03937	15:48819	*See* OMAF/AE–89-1504			
90-03938	15:48820	*See* OMAF/AE–89-2301			
90-03939	15:48789	*See* OMAF/AE–88-4510			
90-03940	15:48787	*See* OMAF–89-4057			
90-03941	15:48822	*See* OMAF/AE–89-5104			
90-03942	15:48821	*See* OMAF/AE–89-5103			
90-03943	15:48191	*See* TU/CEAC–90-03943			
90-03956	15:48858	*See* BWC–90-03956			
90-03966	15:48441	*See* OMNI–90-03966			
90-03968	15:48172	*See* SRC–R-1110-2-C-89			
90-03996	15:49605	*See* OH/RD–89-309-K			
90-03998	15:48678	*See* OH/RD–89-301-K			
90-03999	15:49573	*See* OH/RD–89-55-K			
90-04000	15:49604	*See* OH/RD–89-296-K			
90-04002	15:48895	*See* OH/RD–89-306-K			
90-04079	15:48755	*See* TP–TP9456E			
90-04108	15:48675	*See* LPC–90-04108			
90-04210	15:48955	*See* EM–92			
MINTEK-M–					
400	15:49081	Available from Mintek, Private Bag X3015, Randburg, 2125, South Africa			
402	15:49024	Available from Mintek, Private Bag X3015, Randburg, 2125, South Africa			
MLM–					
3656(OP)	15:50235	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000016	MF-705
MMS–					
84-0005	15:49569	*See* FWS/OBS–82/15			
84-0005	15:49570	*See* FWS/OBS–82/16			
84-0052	15:49571	*See* FWS/OBS–82/46			
MOC–					
90-03394	15:48153	PC Canadian Petroleum Association, 3800 - 150 6th. Ave. S.W., Calgary, AB, CAN T2P 3Y7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
MPI-PAE/Exp.El.–					
226	15:49977	Available from Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik			
MPUB–					
43/90	15:48753	PC Manitoba Legislative Library, 200 Vaughan St., Winnipeg, MB, CAN R3C 1T5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
90-00338	15:48181	PC Manitoba Public Utilities Board, 280 Smith Street, 2nd Floor, Winnipeg, MB, CAN R3C 1K2; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
MRAC–					
90-03425	15:48830	PC Manitoba Legislative Library, 200 Vaughan St., Winnipeg, MB, CAN R3C 1T5; MF CAN-MET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
N–					
90-23518	15:49156	NTIS, PC A03/MF A01			
90-23591	15:49192	NTIS, PC A03/MF A01			
90-23662	15:48459	NTIS, PC A02/MF A01			
90-23754	15:48967	NTIS, PC A03/MF A01			
90-23773	15:48852	NTIS, PC A03/MF A01			
90-24120	15:49818	NTIS, PC A03/MF A01			
90-24121	15:50048	NTIS, PC A03/MF A01			
90-24122	15:49819	NTIS, PC A02/MF A01			
90-24123	15:49820	NTIS, PC A03/MF A01			
90-24211	15:49821	NTIS, PC A03/MF A01			
90-24213	15:49822	NTIS, PC A03/MF A01			
90-24214	15:49823	NTIS, PC A03/MF A01			
90-24349	15:49193	NTIS, PC A03/MF A01			
90-24350	15:48853	NTIS, PC A09/MF A02			
90-24382	15:48969	NTIS, PC A03/MF A01			
90-24405	15:48893	NTIS, PC A10/MF A02			
90-24585	15:48467	NTIS, PC A03/MF A01			
90-24881	15:49824	NTIS, PC A03/MF A01			
90-25031	15:49716	NTIS, PC A03/MF A01			
NAL-TR–					
1023	15:48495	*See* PB–90-255753/XAB			
NAS–					
1.15:102462	15 48969	*See* N–90-24382			
1.15:102561	15:48967	*See* N–90-23754			
1.15:103160	15:48459	*See* N–90-23662			
1.15:103165	15:49193	*See* N–90-24349			
1.15:103176	15:49192	*See* N–90-23591			
1.15:103177	15:49156	*See* N–90-23518			
1.15:103192	15:48852	*See* N–90-23773			
1.26:180615	15:49818	*See* N–90-24120			
1.26:181123	15:49821	*See* N–90-24211			
1.26:183334	15:49822	*See* N–90-24213			
1.26:186604	15:49824	*See* N–90-24881			
1.26:186605	15:50048	*See* N–90-24121			
1.26:186607	15:49823	*See* N–90-24214			
1.26:186608	15:49819	*See* N–90-24122			
1.26:186609	15:49820	*See* N–90-24123			
1.26:4301	15:48893	*See* N–90-24405			
1.55:3074	15:48853	*See* N–90-24350			
1.60:2987	15:49716	*See* N–90-25031			
1.60:2992	15:48467	*See* N–90-24585			
NASA-CP–					
3074	15:48853	*See* N–90-24350			
NASA-CR–					
180615	15:49818	*See* N–90-24120			
181123	15:49821	*See* N–90-24211			
183334	15:49822	*See* N–90-24213			
186604	15:49824	*See* N–90-24881			
186605	15:50048	*See* N–90-24121			
186607	15:49823	*See* N–90-24214			
186608	15:49819	*See* N–90-24122			
186609	15:49820	*See* N–90-24123			
4301	15:48893	*See* N–90-24405			
NASA-TM–					
102462	15:48969	*See* N–90-24382			
102561	15:48967	*See* N–90-23754			
103160	15:48459	*See* N–90-23662			
103165	15:49193	*See* N–90-24349			
103176	15:49192	*See* N–90-23591			
103177	15:49156	*See* N–90-23518			
103188	15:48469	*See* DOE/NASA/33408–4			
103192	15:48852	*See* N–90-23773			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
NASA-TP–					
2987	15:49716	*See* N–90-25031			
2992	15:48467	*See* N–90-24585			
NATO/CCMS–					
170	15:49723	*See* PB–90-252636/XAB			
NBE–					
90-03188	15:48681	PC New Brunswick Legislative Library, Government Documents Section, 766 King St, Fredericton, NB, CAN E3B 5H1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
90-03189	15:48682	PC New Brunswick Legislative Library, Government Documents Section, 766 King St, Fredericton, NB, CAN E3B 5H1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
NBNRE–					
90-03314	15:48745	PC New Brunswick Legislative Library, Government Documents Section, 766 King St, Fredericton, NB, CAN E3B 5H1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
NCAR/CT–					
126	15:49532	*See* PB–90-244807/XAB			
ND-M–					
3888(S)	15:48894	Available from British Library, Document Supply Centre, Boston Spa, Wetherby, West Yorks.			
ND-R–					
1173(S)-Pt.2	15:48662	NTIS (US Sales Only), PC A03/MF A01 - OSTI		DE90706194	
NDA/NF–					
90-03383	15:48174	PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
NEB-SS–					
22-1/1990-5E	15:48187	National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, ON, CAN K1A 0E5. Prices: N/C			
22-1/1990-5F	15:48188	National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, ON, CAN K1A 0E5. Prices: N/C			
NEDO-P–					
2950	15:48741	NTIS (US Sales Only), PC A15/MF A01		DE91701469	
8919	15:49468	NTIS (US Sales Only), PC A08/MF A01		DE91701465	
8927	15:48837	NTIS (US Sales Only), PC A21/MF A01		DE91701463	
8936	15:49469	NTIS (US Sales Only), PC A13/MF A01		DE91701464	
8951	15:48730	NTIS (US Sales Only), PC A06/MF A01		DE91701466	
8952	15:48731	NTIS (US Sales Only), PC A04/MF A01		DE91701467	
8953	15:48732	NTIS (US Sales Only), PC A03/MF A01		DE91701468	
NEI-FI–					
113	15:48785	Sairaalaliitto, Helsinki, Finland			
114	15:48831	JP-International, Helsinki, Finland			
119	15:50236	NTIS (US Sales Only), PC A05/MF A01		DE90518708	
NIFS–					
10	15:50180	NTIS (US Sales Only), PC A03/MF A01		DE90520199	
11	15:50161	NTIS (US Sales Only), PC A03/MF A01		DE90520198	
12	15:50162	NTIS (US Sales Only), PC A03/MF A01		DE90520197	
13	15:50181	NTIS (US Sales Only), PC A03/MF A01		DE90520196	
14	15:50163	NTIS (US Sales Only), PC A03/MF A01		DE90520195	
15	15:50164	NTIS (US Sales Only), PC A03/MF A01		DE90520194	
NIFS-DATA–					
1	15:50087	NTIS (US Sales Only), PC A10/MF A01		DE90520450	
NIIAR–					
28-759	15:48610	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE91602411	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
NIRS–					
26	15:50204	NTIS (US Sales Only), PC A06/MF A01		DE90520444	
27	15:50205	NTIS (US Sales Only), PC A06/MF A01		DE90520443	
NIRS-AR–					
31	15:50206	NTIS (US Sales Only), PC A12/MF A01		DE90520440	
NIRS-RSD–					
88	15:49603	NTIS (US Sales Only), PC A03/MF A01		DE90520442	
89	15:49705	NTIS (US Sales Only), PC A03/MF A01		DE90520441	
NORDIA-TIED–					
A/1	15:48742	Oulu Univ, Finland			
NORSAR-CONTRIB–					
415	15:49402	*See* AD-A–222186/9/XAB			
NOSC/TD–					
1781	15:50210	*See* AD-A–222798/1/XAB			
NSME–					
87-02413	15:48748	PC Nova Scotia Mines and Energy, 1701 Hollis St., PO Box 1087, Halifax, NS, CAN B3J 2X1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
NSP–					
90-02603	15:48518	PC Nova Scotia Power Corporation, Barrington Tower, Scotia Square, PO Box 910,, Halifax, NS, CAN B3J 2W5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
NSWC-TR–					
88-394	15:49223	*See* AD-A–223047/2/XAB			
NSWC/TR–					
89-338	15:48901	*See* AD-A–221936/8/XAB			
NTIA–					
90-263	15:49859	*See* PB–90-252404/XAB			
NUREG–					
0304-Vol.15-No.2	15:48588	NTIS, PC A03/MF A01 - GPO - OSTI		TI90017869	
0540-Vol.12-No.7	15:48589	NTIS, PC A16/MF A01 - GPO; OSTI; INIS		TI90017697	
0750-Vol.32-No.1	15:48590	NTIS, PC A04/MF A01 - GPO; OSTI; INIS		TI90016905	
0940-Vol.9-No.2	15:48591	NTIS, PC A21/MF A01 - GPO - OSTI		TI90017638	
NUREG/CP–					
0112-Vol.1	15:48537	NTIS, PC A14/MF A01 - GPO; OSTI; INIS		TI90017785	
0112-Vol.2	15:48538	NTIS, PC A10/MF A01 - GPO; OSTI; INIS		TI90017698	
NUREG/CR–					
2000-Vol.9-No.8	15:48592	NTIS, PC A05/MF A01 - GPO; OSTI; INIS		TI91000571	
4624-Vol.6	15:48663	NTIS, PC A17/MF A01 - GPO; OSTI; INIS		TI90017696	
5254	15:48664	NTIS, PC A08/MF A01 - GPO; OSTI; INIS		TI91000135	
5395-Vol.11	15:48665	NTIS, PC A22/MF A01 - GPO; OSTI; INIS		TI90017699	
5395-Vol.11-Add.	15:48666	NTIS, PC A12/MF A01 - GPO; OSTI; INIS		TI90017700	
5451	15:48608	NTIS, PC A13/MF A01 - GPO; OSTI; INIS		TI90017530	
5554	15:48571	NTIS, PC A04/MF A01 - GPO; OSTI; INIS		TI91000362	
5575	15:48667	NTIS, PC A08/MF A01 - GPO; OSTI; INIS		TI90017651	
5640	15:48539	NTIS, PC A25/MF A01 - GPO; OSTI; INIS		TI91000422	
OAF/AED–					
89-6508	15:48812	PC Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, CAN N1H 6N1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
OCS/EIS/EA/MMS–					
90-0042-Vol.1	15:48705	OSTI; US Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, 1201 Elmwood Park Blvd., New Orleans, LA 70123-2394		TI90017409	
90-0042-Vol.2	15:48154	OSTI; US Department of Interior, Minerals Management Service, Gulf of Mexico OCS Region, 1201 Elmwood Park Blvd, New Orleans, LA 70923-2394		TI90017410	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
OE/RT–					
90-03626-Vol.2	15:48733	PC Publications Ontario, 880 Bay St, 5th Floor, Toronto, ON, CAN M7A 1N8; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $6.00 CAN; MF $10 CAN			
OH/RD–					
403G348	15:49473	Canadian Electrical Association, One Westmount Square, Suite 500, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NONMEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN			
89-173-K	15:48453	PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
89-230-K	15:49186	PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
89-231-K	15:48786	PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
89-232-K	15:48494	PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
89-235-K	15:48450	PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
89-252-K	15:48676	PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
89-259-K	15:49729	PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
89-261-K	15:48970	PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
89-262-K	15:49472	PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-274-K	15:48689	PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
89-275-K	15:48677	PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
89-296-K	15:49604	PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
89-301-K	15:48678	PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
89-306-K	15:48895	PC Ontario Hydro Research Division, Editorial Section, 800 Kipling Ave., Toronto, Ont., CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
89-309-K	15:49605	PC Ontario Hydro Research Division, Editorial Section, 800 Kipling Ave., Toronto, Ont., CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
89-55-K	15:49573	PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
OIES-EE–					
7	15:48142	Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ			
OMAF–					
89-4057	15:48787	PC Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, CAN N1H 6N1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
OMAF/AE–					
88-07	15:48788	Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, CAN N1H 6N1. Prices: N/C			
88-4510	15:48789	PC Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, CAN N1H 6N1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
89-01	15:48813	Ontario Agriculture and Food, Communications Branch, 801 Bay St, 12th Floor, Toronto, ON, CAN M7A 2B2. Prices: PRICES UPON REQUEST			
89-02	15:48814	Ontario Agriculture and Food, Communications Branch, 801 Bay St, 12th Floor, Toronto, ON, CAN M7A 2B2. Prices: PRICES UPON REQUEST			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-03	15:48815	Ontario Agriculture and Food, Communications Branch, 801 Bay St, 12th Floor, Toronto, ON, CAN M7A 2B2. Prices: PRICES UPON REQUEST			
89-04	15:48816	Ontario Agriculture and Food, Communications Branch, 801 Bay St, 12th Floor, Toronto, ON, CAN M7A 2B2. Prices: PRICES UPON REQUEST			
89-05	15:48817	Ontario Agriculture and Food, Communications Branch, 801 Bay St, 12th Floor, Toronto, ON, CAN M7A 2B2. Prices: PRICES UPON REQUEST			
89-06	15:48818	Ontario Agriculture and Food, Communications Branch, 801 Bay St, 12th Floor, Toronto, ON, CAN M7A 2B2. Prices: PRICES UPON REQUEST			
89-08	15:48790	Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, CAN N1H 6N1. Prices: N/C			
89-1504	15:48819	PC Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, CAN N1H 6N1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
89-2301	15:48820	PC Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, CAN N1H 6N1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
89-5103	15:48821	PC Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, CAN N1H 6N1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
89-5104	15:48822	PC Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, CAN N1H 6N1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
OMNI–					
90-03966	15:48441	PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
ORNL–					
6584	15:48608	*See* NUREG/CR–5451			
ORNL/FTR–					
3713	15:48933	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017311	MF-404
3716	15:48407	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017559	MF-400
3721	15:48896	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017502	MF-404
3724	15:50089	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017503	MF-411
3725	15:48578	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017730	MF-504
3729	15:49645	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017558	MF-408
3730	15:49316	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017843	MF-410
3731	15:49163	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017312	MF-406
3732	15:49917	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017731	MF-411
3737	15:48668	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017872	MF-523
3739	15:49574	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017627	MF-402
3741	15:49082	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017850	MF-401
3742	15:49412	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017842	MF-402
ORNL/M–					
1250	15:49391	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017500	MF-405
ORNL/NSIC–					
200-Vol.9-No.8	15:48592	*See* NUREG/CR–2000-Vol.9-No.8			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
ORNL/RASA–					
89/10	15:49575	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017844	MF-511
ORNL/TM–					
11509	15:48571	*See* NUREG/CR–5554			
11637	15:50237	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018037	MF-405
OSWERDIRECTIVE–					
9330.2-05	15:48708	*See* PB–90-249624/XAB			
OTA-BP-E–					
57	15:48700	*See* PB–90-254145/XAB			
OTA-E–					
453	15:48517	*See* PB–90-253287/XAB			
OTH–					
87-247	15:49195	Available from H.M. Stationery Office, London, price Pound 36.50			
88-287	15:49196	Also available from H.M. Stationery Office, price Pound 25.50			
OTI–					
89-541	15:49197	Available from H.M. Stationery Office, London, price Pound 12.75			
OTO–					
89-005	15:49198	Available from British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ No. DX86817			
89-022	15:48971	Available from British Library, Document Supply Centre, Boston Spa, Wetherby, West Yorks.			
OUP–					
90-10	15:50207	NTIS (US Sales Only), PC A05/MF A01; OSTI; INIS		DE91602692	
OWMC–					
1887-01	15:49576	PC Ontario Waste Management Corporation, 2 Bloor St. West, 11th. Fl., Communications Service, Toronto, ON, CAN M4W 3E2; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
PB–					
90-234006/XAB	15:49474	NTIS, PC EE99/MF E99			
90-234014/XAB	15:49475	NTIS, PC A06/MF A01			
90-234022/XAB	15:49476	NTIS, PC A11/MF A02			
90-234030/XAB	15:49477	NTIS, PC A03/MF A01			
90-234048/XAB	15:49478	NTIS, PC A03/MF A01			
90-234055/XAB	15:49479	NTIS, PC A04/MF A01			
90-234063/XAB	15:49480	NTIS, PC A04/MF A01			
90-234071/XAB	15:49481	NTIS, PC A05/MF A01			
90-234089/XAB	15:49482	NTIS, PC A03/MF A01			
90-234097/XAB	15:49483	NTIS, PC A03/MF A01			
90-234105/XAB	15:49484	NTIS, PC A03/MF A01			
90-234113/XAB	15:49485	NTIS, PC A03/MF A01			
90-234121/XAB	15:49486	NTIS, PC A03/MF A01			
90-234139/XAB	15:49487	NTIS, PC A05/MF A01			
90-234147/XAB	15:49488	NTIS, PC A06/MF A01			
90-234154/XAB	15:49489	NTIS, PC A04/MF A01			
90-234162/XAB	15:49490	NTIS, PC A04/MF A01			
90-234170/XAB	15:49491	NTIS, PC A08/MF A01			
90-234188/XAB	15:49492	NTIS, PC A03/MF A01			
90-234196/XAB	15:49493	NTIS, PC A03/MF A01			
90-234204/XAB	15:49494	NTIS, PC A03/MF A01			
90-234212/XAB	15:49495	NTIS, PC A03/MF A01			
90-234220/XAB	15:49496	NTIS, PC A05/MF A01			
90-234238/XAB	15:49497	NTIS, PC A04/MF A01			
90-234279/XAB	15:49498	NTIS, PC EE99/MF E99			
90-234287/XAB	15:49499	NTIS, PC A05/MF A01			
90-234295/XAB	15:49500	NTIS, PC A02/MF A01			
90-234303/XAB	15:49501	NTIS, PC A05/MF A01			
90-234311/XAB	15:49606	NTIS, PC A04/MF A01			
90-234329/XAB	15:49502	NTIS, PC A04/MF A01			
90-234337/XAB	15:49503	NTIS, PC A21/MF A03			
90-234345/XAB	15:49504	NTIS, PC A10/MF A02			
90-234352/XAB	15:49505	NTIS, PC A11/MF A02			
90-234360/XAB	15:49506	NTIS, PC A04/MF A01			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
90-234378/XAB	15:49507	NTIS, PC A05/MF A01			
90-234386/XAB	15:49508	NTIS, PC A03/MF A01			
90-234394/XAB	15:49509	NTIS, PC A03/MF A01			
90-234402/XAB	15:49510	NTIS, PC A05/MF A01			
90-234428/XAB	15:49511	NTIS, PC A03/MF A01			
90-234436/XAB	15:49512	NTIS, PC A08/MF A01			
90-234444/XAB	15:49513	NTIS, PC A03/MF A01			
90-234451/XAB	15:48146	NTIS, PC A08/MF A01			
90-234469/XAB	15:49514	NTIS, PC A03/MF A01			
90-234477/XAB	15:49515	NTIS, PC EE99/MF E99			
90-234485/XAB	15:49577	NTIS, PC A11/MF A02			
90-234493/XAB	15:49516	NTIS, PC A11/MF A02			
90-234501/XAB	15:49517	NTIS, PC A12/MF A02			
90-234519/XAB	15:49607	NTIS, PC A09/MF A02			
90-234527/XAB	15:49518	NTIS, PC A19/MF A03			
90-234535/XAB	15:49519	NTIS, PC A14/MF A02			
90-234543/XAB	15:49520	NTIS, PC A11/MF A02			
90-234550/XAB	15:49521	NTIS, PC A10/MF A02			
90-234568/XAB	15:49522	NTIS, PC A15/MF A02			
90-234576/XAB	15:49523	NTIS, PC A17/MF A03			
90-234584/XAB	15:49524	NTIS, PC A11/MF A02			
90-234592/XAB	15:49525	NTIS, PC A11/MF A02			
90-234600/XAB	15:49526	NTIS, PC A11/MF A02			
90-234618/XAB	15:49608	NTIS, PC A12/MF A02			
90-234626/XAB	15:49527	NTIS, PC A09/MF A01			
90-234634/XAB	15:49528	NTIS, PC A10/MF A02			
90-234642/XAB	15:48147	NTIS, PC A10/MF A02			
90-234659/XAB	15:49529	NTIS, PC A14/MF A02			
90-234667/XAB	15:49530	NTIS, PC A04/MF A01			
90-234683/XAB	15:49578	NTIS, PC A07/MF A01			
90-234691/XAB	15:49579	NTIS, PC A19/MF A03			
90-234709/XAB	15:49609	NTIS, PC A12/MF A02			
90-240912/XAB	15:49610	NTIS, PC A05/MF A01			
90-244393/XAB	15:49531	NTIS, PC A13/MF A02			
90-244591/XAB	15:49891	NTIS(Order as PB90-244526)			
90-244807/XAB	15:49532	NTIS, PC A11/MF A02			
90-245069/XAB	15:49719	NTIS, PC A04/MF A01			
90-245077/XAB	15:49720	NTIS, PC A07/MF A01			
90-246802/XAB	15:48803	NTIS, PC A07/MF A01			
90-247149/XAB	15:49533	NTIS, PC A03/MF A01			
90-247156/XAB	15:49534	NTIS, PC A03/MF A01			
90-247164/XAB	15:49611	NTIS, PC A03/MF A01			
90-247172/XAB	15:49535	NTIS, PC A03/MF A01			
90-247214/XAB	15:48823	NTIS, PC A06/MF A01			
90-247230/XAB	15:48121	NTIS, PC A03/MF A01			
90-247339/XAB	15:49536	NTIS, PC A03/MF A01			
90-247347/XAB	15:49721	NTIS, PC A04/MF A01			
90-247404/XAB	15:48179	NTIS, PC A07/MF A01			
90-247412/XAB	15:48177	NTIS, PC A18/MF A03			
90-247552/XAB	15:48155	NTIS, PC A17/MF A03			
90-247727/XAB	15:48156	NTIS, PC A03/MF A01			
90-248907/XAB	15:49537	NTIS, PC A08/MF A01			
90-248915/XAB	15:49722	NTIS, PC A07/MF A01			
90-249491/XAB	15:48706	NTIS, PC A03/MF A01			
90-249541/XAB	15:48707	NTIS, PC A02/MF A01			
90-249566/XAB	15:49580	NTIS, PC A02/MF A01			
90-249574/XAB	15:48157	NTIS, PC A02/MF A01			
90-249582/XAB	15:49581	NTIS, PC A03/MF A01			
90-249616/XAB	15:49612	NTIS, PC A02/MF A01			
90-249624/XAB	15:48708	NTIS, PC A02/MF A01			
90-249657/XAB	15:48709	NTIS, PC A03/MF A01			
90-249681/XAB	15:48710	NTIS, PC A03/MF A01			
90-249715/XAB	15:48158	NTIS, PC A02			
90-249731/XAB	15:48711	NTIS, PC A03/MF A01			
90-249756/XAB	15:48712	NTIS, PC A07/MF A01			
90-249772/XAB	15:48713	NTIS, PC A07/MF A01			
90-249798/XAB	15:48159	NTIS, PC A01/MF A01			
90-250127/XAB	15:48160	NTIS, PC A05/MF A01			
90-250135/XAB	15:49538	NTIS, PC A14/MF A02			
90-250143/XAB	15:48073	NTIS, PC A08/MF A01			
90-250176/XAB	15:49613	NTIS, PC A07/MF A01			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
90-250267/XAB	15:48161	NTIS, PC A08/MF A01			
90-250366/XAB	15:49539	NTIS, PC A02/MF A01			
90-250382/XAB	15:49614	NTIS, PC A03/MF A01			
90-250424/XAB	15:49615	NTIS, PC A03/MF A01			
90-250432/XAB	15:49616	NTIS, PC A03/MF A01			
90-250440/XAB	15:49617	NTIS, PC A03/MF A01			
90-250630/XAB	15:48791	NTIS, PC A06/MF A01			
90-250655/XAB	15:48474	NTIS, PC A10/MF A02)			
90-250663/XAB	15:48475	NTIS, PC A10/MF A02			
90-251422/XAB	15:49214	NTIS, PC A05/MF A01			
90-251430/XAB	15:49215	NTIS, PC A05/MF A01			
90-251448/XAB	15:48934	NTIS, PC A05/MF A01			
90-251455/XAB	15:48935	NTIS, PC A05/MF A01			
90-251992/XAB	15:48437	NTIS, PC A03/MF A01			
90-252065/XAB	15:48207	NTIS, PC A05/MF A01			
90-252396/XAB	15:49618	NTIS, PC A16/MF A02			
90-252404/XAB	15:49859	NTIS, PC A09/MF A01			
90-252420/XAB	15:48103	NTIS, PC A12/MF A02			
90-252495/XAB	15:49540	NTIS, PC A17/MF A03			
90-252545/XAB	15:48178	NTIS, PC A12/MF A02			
90-252552/XAB	15:48190	NTIS, PC A04/MF A01			
90-252560/XAB	15:48762	NTIS, PC A03/MF A01			
90-252578/XAB	15:48081	NTIS, PC A04/MF A01			
90-252586/XAB	15:48792	NTIS, PC A08/MF A01			
90-252636/XAB	15:49723	NTIS, PC A99/MF A04			
90-252727/XAB	15:50238	NTIS, PC A03/MF A01			
90-253170/XAB	15:49541	NTIS, PC A04/MF A01			
90-253188/XAB	15:49542	NTIS, PC A11/MF A02			
90-253220/XAB	15:48824	NTIS, PC A04/MF A01			
90-253287/XAB	15:48517	NTIS, PC A04/MF A01			
90-253659/XAB	15:49619	NTIS, PC A03/MF A01			
90-253667/XAB	15:49620	NTIS, PC A03/MF A01			
90-253675/XAB	15:49621	NTIS, PC A03/MF A01			
90-253683/XAB	15:49622	NTIS, PC A03/MF A01			
90-253691/XAB	15:49582	NTIS, PC A03/MF A01			
90-253709/XAB	15:49623	NTIS, PC A03/MF A01			
90-253717/XAB	15:49624	NTIS, PC A03/MF A01			
90-253725/XAB	15:49625	NTIS, PC A03/MF A01			
90-253733/XAB	15:49626	NTIS, PC A03/MF A01			
90-253741/XAB	15:49627	NTIS, PC A03/MF A01			
90-254145/XAB	15:48700	NTIS, PC A04/MF A01			
90-254293/XAB	15:49628	NTIS, PC A12/MF A02			
90-254301/XAB	15:49629	NTIS, PC A04/MF A01			
90-254319/XAB	15:49630	NTIS, PC A03/MF A01			
90-254335/XAB	15:49631	NTIS, PC A05/MF A01			
90-254988/XAB	15:49543	NTIS, PC A03/MF A01			
90-255050/XAB	15:49724	NTIS, PC A06/MF A01			
90-255068/XAB	15:49725	NTIS, PC A09/MF A02			
90-255126/XAB	15:48763	NTIS, PC A03/MF A01			
90-255480/XAB	15:49216	NTIS, PC A08/MF A01			
90-255662/XAB	15:49544	NTIS, PC A05/MF A01			
90-255753/XAB	15:48495	NTIS, PC A04/MF A01			
90-256785/XAB	15:49545	NTIS, PC A05/MF A01			
90-257494/XAB	15:49632	NTIS, PC A03/MF A01			
90-257809/XAB	15:49633	NTIS, PC A12/MF A02			
90-502618/XAB	15:48714	NTISCP D01			
90-502626/XAB	15:48715	NTISCP D01			
90-502634/XAB	15:48716	NTISCP D01			
90-502642/XAB	15:48717	NTISCP D01			
90-502659/XAB	15:48718	NTISCP D01			
90-502667/XAB	15:48719	NTISCP D01			
90-502675/XAB	15:48720	NTISCP D01			
90-502683/XAB	15:48721	NTISCP D01			
90-502691/XAB	15:48722	NTISCP D01			
90-502709/XAB	15:48723	NTISCP D01			
90-591780/XAB	15:48724	NTISSubscription			
90-591790/XAB	15:48725	NTISSubscription			
PIRSEM–					
2012	15:48764	NTIS (US Sales Only), PC A03/MF A01		DE91701151	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
PMA–					
90-02942	15:48143	PC Petroleum Monitoring Agency, 580 Booth St., Ottawa, ON, CAN K1A 0E4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF .10 CAN			
PNL–					
5895	15:49741	NTIS, PC A13/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017516	MF-903
6450-34-HEDR	15:49546	OSTI; GPO Dep.	E 1.99:	DE90017649	MF-707
7145	15:49151	National Energy Software Center (software packages requested by US Government Agencies and their Contractors), Argonne National Lab. Argonne, IL (312-972-7250 or FTS 972-7250). Other requestors should be directed to PNL			ND-602; ND-630
7201	15:49547	National Energy Software Center (software packages requested by U.S. Government Agencies and their contractors), Argonne National Lab., Argonne, IL (312)972-7250) or FTS (972-7250). Other requestors should be directed to PNL.			ND-602; ND-630
7216-Vol.1	15:49548	National Energy Software Center (software packages requested by U.S. Government Agencies and Their Contractors), Argonne National Lab., Argonne, IL (312-972-7250 or FTS 972-7250). Other requestors should be directed to PNL			ND-602; ND-630
7216-Vol.2	15:49583	National Energy Software Center (software packages requested by US Government Agencies and their Contractors), Argonne National Lab., Argonne, IL (312-972-7250 or FTS 972-7250). Other requestors should be directed to PNL.			ND-602; ND-630
7354	15:48233	*See* EPRI-NP–6940			
7397	15:48793	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014843	MF-310
7403	15:48496	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016666	MF-202
7435	15:49584	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018008	MF-702
7441	15:48690	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018007	MF-202
7449	15:48794	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017517	MF-350
PNL-SA–					
17279	15:48442	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017188	MF-920
17566	15:48287	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017187	MF-510
17678	15:48972	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017645	MF-404
17865	15:49640	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017646	
17925	15:50255	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016337	MF-500
17985	15:48825	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016357	MF-321
18081	15:49025	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016535	MF-401
18095	15:50239	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017239	MF-506
18212	15:48987	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016560	MF-501; MF-505
18290	15:49730	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017240	MF-201
18353	15:48497	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017238	MF-500
18436	15:48795	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016538	MF-900
PPP-JULK–					
9	15:49549	Suomen Akatemja, Helsinki, Finland			
PPRP/PPSE/SH–					
2	15:48155	*See* PB–90-247552/XAB			
PSC–					
6	15:49825	NTIS (US Sales Only), PC A03/MF A01		DE90520190	
7	15:50165	NTIS (US Sales Only), PC A03/MF A01		DE90520329	
PSI–					
73	15:49152	NTIS (US Sales Only), PC A05/MF A01; OSTI; INIS		DE91601385	
PSR–					
1846	15:49708	*See* AD-A–222880/7/XAB			
PTR–					
90-4	15:49200	*See* AD-A–222607/4/XAB			
PWR/FBWG/P–					
(86)397-Pt.2	15:48662	*See* ND-R–1173(S)-Pt.2			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
PWR/HTWG/P–					
(86)440-Pt.2	15:48662	*See* ND-R–1173(S)-Pt.2			
QMER/BEEN–					
90-02589	15:48743	PC Ministere de l'energie et des ressources, Direction des communications, 5700, 4e av. ouest, D-309, Charlesbourg, PQ, CAN G1H 6R1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
QMLCP/SAEF–					
90-01788	15:49634	PC Ministere du loisir, de la chasse et de la peche du Quebec, Direction des communications, 150, St-Cyrille Blvd. E., Quebec, PQ, CAN G1R 4Y1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
RAL–					
90-022	15:50182	NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS		DE90706209	
90-030	15:49957	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91601032	
REPT–					
90-1A	15:48207	*See* PB–90-252065/XAB			
RERF-TR–					
4-90	15:49717	NTIS (US Sales Only), PC A03/MF A01		DE90520241	
RFP–					
4418	15:50104	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014471	MF-700
4433	15:48393	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015672	MF-706
RIVM–					
728518005	15:48156	*See* PB–90-247727/XAB			
758473013	15:49537	*See* PB–90-248907/XAB			
758473013	15:49722	*See* PB–90-248915/XAB			
758474011	15:49724	*See* PB–90-255050/XAB			
RMA-TR–					
0103	15:49854	*See* AD-A–222612/4/XAB			
RRK–					
90-9	15:50105	NTIS (US Sales Only), PC A03/MF A01		DE90520328	
RRTAC–					
88-6	15:48734	PC Alberta Heritage Scholarship Fund Alberta, Reclamation Research, Technical Advisory Committee, 2nd floor, Pacific Plaza, 10909 Jasper Ave., Edmonton, AB, CAN T5J 3M8; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
89-2-Vol.1	15:49413	PC Alberta Queen's Printer, Publications Office, 11510 Kingsway Ave, Edmonton, AB, CAN T5G 2Y5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
89-2-Vol.2	15:49414	PC Alberta Queen's Printer, Publications Office, 11510 Kingsway Ave, Edmonton, AB, CAN T5G 2Y5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
SAAO–					
14	15:49826	Available from the South African Astronomical Observatory, PO Box 9, Observatory, 7935, South Africa			
SAIC–					
89/1541	15:48539	*See* NUREG/CR–5640			
SAND–					
2033C	15:49191	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017595	MF-706
2302C	15:49083	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000043	MF-704
89-0423	15:49406	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016692	PC-700
90-0097C	15:48470	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90009834	MF-700

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
90-0325C	15:48478	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90013837	MF-703
90-0390	15:48468	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014863	MF-212
90-0494	15:48394	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016689	PC-830
90-0650C	15:49217	NTIS, PC A02/MF A01 - OSTI		DE90015562	MF-706
90-0688C	15:49218	NTIS, PC A02/MF A01 - OSTI		DE90015563	MF-706
90-0881C	15:48973	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017593	MF-701
90-1008C	15:48726	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000021	MF-902
90-1031C	15:48288	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016219	MF-721
90-1126C	15:49742	NTIS, PC A02/MF A01 - OSTI		DE90017596	MF-703
90-1200-C-Extd.Abst.	15:49164	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90010820	MF-700
90-1248C	15:49165	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90013463	MF-722
90-1250	15:49393	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014865	MF-706
90-1323C	15:49190	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017038	MF-706
90-1346C	15:50202	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000026	MF-700
90-1676C	15:49892	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015989	MF-704
90-1696C	15:48479	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90013399	MF-703
90-1718C	15:48974	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015698	MF-704
90-1729C	15:50240	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90013074	MF-705
90-1747C	15:49379	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90013075	MF-700
90-1755C	15:48975	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017028	MF-704
90-1756C	15:48976	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017031	MF-704
90-2034C	15:50241	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015829	MF-706
90-2053C	15:49166	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015392	MF-705
90-2108C	15:48897	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000035	MF-704
90-2153C	15:48977	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015715	MF-706
90-2173C	15:49367	NTIS, PC A02/MF A01 - OSTI		DE90015993	MF-705
90-2191C	15:48978	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017036	MF-704
90-2272C	15:48460	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017040	MF-275
90-2282C	15:48979	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017032	MF-704
90-2317C	15:49893	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017033	
SASKOIL–					
89-05826	15:48144	PC Saskoil, 1000 Grenfell Tower, 1945 Hamilton St., PO Box 1550, Regina, SK, CAN S4P 3C4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
SCI-TR–					
41	15:48267	*See* DOE-RW–89.107			
SCI-UD–					
18	15:48264	*See* DOE-RW–89.106(v.1)			
19	15:48265	*See* DOE-RW–89.106(v.2)			
20	15:48266	*See* DOE-RW–89.106(v.3)			
SCIENTIFIC–					
1	15:49396	*See* AD-A–223108/2/XAB			
SEM–					
90-03451	15:48728	PC Saskatchewan Energy and Mines, 1914 Hamilton St., Regina, Sask., CAN S4P 4V4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
SERI/CP–					
211-3976	15:48461	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000377	MF-270
SERI/TP–					
211-3906	15:48462	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000356	MF-271
211-3908	15:48463	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000355	MF-271
211-3918	15:48464	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000364	MF-271
231-3622	15:48833	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000361	MF-249
253-3616	15:48471	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000304	MF-262
257-3795	15:48483	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000370	MF-261
257-3939	15:48484	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000373	MF-261
SIEMENS-KWU-E–					
141/89/244	15:48289	Copy held by UB/TIB Hannover			
SKN–					
35	15:48290	NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS		DE90640174	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
SRC–					
R-1110-2-C-89	15:48172	PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
SSC-CC–					
273-2/89-23E	15:49718	*See* MIC–90-03624/XAB			
273-2/89-24E	15:49728	*See* MIC–90-03619/XAB			
273-2/89-27E	15:49715	*See* MIC–90-03615/XAB			
SSC-T–					
1-8/1989	15:48150	*See* MIC–90-03290/XAB			
SSS-TR–					
89-10395	15:49403	*See* AD-A–223148/8/XAB			
ST–					
88-28	15:48754	PC Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $20.00 CAN; MF $10 CAN			
88-43	15:48204	Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4. Prices: $20.00 CAN			
89-17	15:48133	Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4. Prices: $20.00 CAN			
89-18	15:48131	Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4. Prices: $80.00 CAN			
STD–					
87-25	15:49694	Available from The British Library, Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ. Price Pound 25.00			
87-26	15:49695	Available from The British Library, Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ. Price Pound 25.00			
87-39	15:49696	Available from The British Library, Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ. Price Pound 10.00			
88-29	15:49697	Available from The British Library, Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ. Price Pound 25.00			
89-19	15:49698	Available from The British Library, Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ. Price Pound 25.00			
TKK-KO/LVI–					
B27	15:48796	Helsinki Univ of Technology, Otaniemi, Finland, Lab of Heating, Veatilation and Air Conditioning			
TP–					
208	15:48165	PC Transport Canada, Library and Information Centre, Place de Ville, Tower C, Ottawa, ON, CAN K1A 0N5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
TP9456E	15:48755	PC Transport Canada, Library and Information Centre, Place de Ville, Tower C, Ottawa, ON, CAN K1A 0N5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
TR–					
6	15:48454	*See* AD-A–222717/1/XAB			
8	15:50108	*See* AD-A–222719/7/XAB			
95	15:49031	*See* AD-A–222605/8/XAB			
97	15:49030	*See* AD-A–222603/3/XAB			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
TR-EL–					
82-4/82(11.118)	15:49588	*See* BR–82(11.118)			
TRI-PP–					
90-22	15:49894	NTIS (US Sales Only), PC A02/MF A01 - OSTI		DE90017756	
90-25	15:49265	NTIS (US Sales Only), PC A02/MF A01 - OSTI		DE90017755	
90-44	15:50051	NTIS (US Sales Only), PC A02/MF A01 - OSTI		DE90017757	
TU/CEAC–					
90-03943	15:48191	PC Toronto Planning and Development Dept, Library, City Hall, 19th Floor, East Tower, Toronto, ON, CAN M5H 2N2; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
UCRL–					
101932-Rev.1	15:49167	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016211	MF-706
102263-Rev.2	15:50242	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90010872	MF-405
102264	15:49168	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003917	MF-707
102523-Rev.1	15:49652	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016480	MF-406; MF-408
102842	15:49381	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017522	MF-706
102843	15:49382	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017521	MF-706
102942	15:49394	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017520	MF-700; MF-705
98005	15:49380	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015914	
UCRL-CR–					
104383	15:48701	NTIS, PC A14/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016407	MF-700
104589	15:49219	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000019	MF-705
UCRL-ID–					
104196	15:48373	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016676	MF-706
104571	15:49731	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018005	MF-707
104759	15:49400	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90018006	MF-700
UCRL-JC–					
103328	15:49220	NTIS, PC A02/MF A01 - OSTI		DE90016860	
103573	15:50243	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90011231	MF-705
103762	15:49318	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017518	MF-705
103783	15:49266	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017527	MF-712
103797	15:49237	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000258	MF-700
103825	15:49238	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000253	MF-700
103948	15:50088	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90012091	MF-406
104223-Rev.1	15:49836	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017519	MF-700
104272	15:49743	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015123	MF-703
104276	15:49395	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017525	MF-700; MF-706
104359	15:48851	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016470	MF-700
104361	15:48395	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017524	MF-705
104493	15:50244	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015192	MF-706
104547	15:48291	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016861	MF-721
104665	15:49895	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017528	MF-712
104721	15:48898	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017526	MF-400; MF-404
UCSC/IMS–					
90/1	15:48161	*See* PB–90-250267/XAB			
UDR-TM–					
89-15	15:49389	*See* AD-A–222850/0/XAB			
UDR-TR–					
90-57	15:48854	*See* AD-A–222891/4/XAB			
UJV–					
8605-R,T	15:48584	NTIS (US Sales Only), PC A05/MF A01; OSTI; INIS		DE91602511	
8855-R	15:48599	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602382	
8981-T	15:48585	NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS		DE91602512	
8982-T	15:48586	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE91602513	
9040-V	15:50208	NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS		DE91602691	
USAFETAC/TN–					
90/001	15:49851	*See* AD-A–222574/6/XAB			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
UVA–					
525398/MS90/104	15:48902	*See* AD-A–222635/5/XAB			
VYH-JULK–					
22	15:49636	National Board of Waters and the Environment, Helsinki, Finland			
WAU/CGS–					
CE03140	15:49744	Canadian Geotechnical Society, University of Waterloo, Waterloo, ON, CAN . Prices: PRICES UPON REQUEST			
WHC-EP–					
0063-1	15:48292	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017728	MF-721
0275-Rev.2	15:48293	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90017533	MF-630
WHC-SA–					
0483	15:49557	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017727	MF-602
0821	15:48669	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017729	MF-700
WHOI–					
84-28	15:49610	*See* PB–90-240912/XAB			
WRDC-TR–					
90-1080	15:49390	*See* AD-A–222972/2/XAB			
Y/DX–					
943	15:49169	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90012970	MF-706; MF-705
Y/IB–					
20	15:49386	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016927	MF-706

Order Number Correlation

The correlation list is provided for those organizations that file documents by report number but may receive requests by order number. For more information about a document, refer to the Report Number Index.

Order No.	Report No.
DE90000304	SERI/TP–253-3616
DE90000355	SERI/TP–211-3908
DE90000356	SERI/TP–211-3906
DE90000361	SERI/TP–231-3622
DE90000364	SERI/TP–211-3918
DE90000366	DOE/CH/10093–78
DE90000370	SERI/TP–257-3795
DE90000373	SERI/TP–257-3939
DE90000377	SERI/CP–211-3976
DE90000490	DOE/METC–90/6112
DE90003917	UCRL–102264
DE90007150	BNL–43758
DE90008748	CONF-901109–1
DE90008750	ETDE/PUB–2
DE90009663	DOE/MC/11076–2851
DE90009667	DOE/MC/11076–2834
DE90009671	DOE/MC/24207–2858
DE90009672	DOE/MC/24207–2857
DE90009678	DOE/MC/23077–2866
DE90009697	DOE/MC/23270–2876
DE90009834	SAND–90-0097C
DE90010820	SAND–90-1200-C-Extd.Abst.
DE90010872	UCRL–102263-Rev.2
DE90010929	EGG-M–90041
DE90011180	CONF-901109–4
DE90011231	UCRL-JC–103573
DE90011636	CONF-901150–1
DE90011973	LA-UR–90-1641
DE90012000	LA-UR–90-1845
DE90012059	LA-UR–90-1833
DE90012091	UCRL-JC–103948
DE90012097	LA-UR–90-1548
DE90012934	CONF-901101–12
DE90012941	CONF-901101–11
DE90012942	CONF-901101–10
DE90012948	CONF-901101–9
DE90012964	EGG-M–90064
DE90012970	Y/DX–943
DE90012979	CONF-901101–8
DE90013074	SAND–90-1729C
DE90013075	SAND–90-1747C
DE90013092	EGG-M–90249
DE90013099	EGG-M–90067
DE90013151	LA-UR–90-2164
DE90013168	LA-UR–90-2055
DE90013399	SAND–90-1696C
DE90013463	SAND–90-1248C
DE90013661	CONF-901109–8
DE90013662	CONF-901121–4
DE90013663	CONF-901101–17
DE90013837	SAND–90-0325C
DE90014206	CONF-901101–20
DE90014208	CONF-901101–19
DE90014217	CONF-901101–18
DE90014447	CONF-901104–1
DE90014471	RFP–4418
DE90014508	LBL–27358
DE90014843	PNL–7397
DE90014847	DOE/PE–0095P
DE90014863	SAND–90-0390
DE90014865	SAND–90-1250
DE90014896	LA-UR–90-2514
DE90014979	LA-UR–90-2571
DE90015031	LA-UR–90-2308
DE90015057	LA-UR–90-2562
DE90015058	LA-UR–90-2564
DE90015060	LA-UR–90-2577
DE90015104	LA-UR–90-2212
DE90015123	UCRL-JC–104272
DE90015125	BNL-NUREG–44847
DE90015153	CONF-901105–3
DE90015162	CONF-901101–24
DE90015192	UCRL-JC–104493
DE90015354	HW–72042
DE90015392	SAND–90-2053C
DE90015424	DOE/PC/89651–T1
DE90015535	CONF-901101–27
DE90015538	CONF-901177–1
DE90015543	CONF-901109–12
DE90015545	CONF-901178–1
DE90015562	SAND–90-0650C
DE90015563	SAND–90-0688C
DE90015598	CONF-901109–14
DE90015606	CONF-901109–18
DE90015672	RFP–4433
DE90015698	SAND–90-1718C
DE90015715	SAND–90-2153C
DE90015829	SAND–90-2034C
DE90015914	UCRL–98005
DE90015964	DOE/ER–0454
DE90015989	SAND–90-1676C
DE90015993	SAND–90-2173C
DE90016030	CONF-901194–1
DE90016037	CONF-901194–2
DE90016041	CONF-901121–6
DE90016187	DOE/ER/14064–1
DE90016188	DOE/ER/14057–1
DE90016204	DOE/EA–0338
DE90016205	DOE/EA–0333
DE90016211	UCRL–101932-Rev.1
DE90016219	SAND–90-1031C
DE90016281	LBL–28268
DE90016302	DOE/CE/90029–3
DE90016337	PNL-SA–17925
DE90016357	PNL-SA–17985
DE90016407	UCRL-CR–104383
DE90016446	LA-UR–90-2856
DE90016470	UCRL-JC–104359
DE90016480	UCRL–102523-Rev.1
DE90016487	LA-UR–90-2828
DE90016492	LA-UR–90-2777
DE90016521	CONF-9010185–1
DE90016535	PNL-SA–18081
DE90016538	PNL-SA–18436
DE90016560	PNL-SA–18212
DE90016619	LBL–28197
DE90016661	KAPL–4718
DE90016666	PNL–7403
DE90016676	UCRL-ID–104196
DE90016689	SAND–90-0494
DE90016692	SAND–89-0423
DE90016699	IS-M–618
DE90016700	IS-M–619
DE90016701	IS-M–620
DE90016704	IS-M–623
DE90016706	IS-M–628
DE90016707	IS-M–629
DE90016708	IS-M–630
DE90016709	IS-M–631
DE90016710	IS-M–632
DE90016711	IS-M–633
DE90016712	IS-M–634
DE90016713	IS-M–635
DE90016718	LA-UR–90-2638
DE90016719	LA-UR–90-2637
DE90016758	DOE/PC/88889–T5
DE90016792	DOE/PC/88800–26
DE90016860	UCRL-JC–103328
DE90016861	UCRL-JC–104547
DE90016874	CONF-901101–29
DE90016927	Y/IB–20
DE90017022	CONF-901097–1
DE90017028	SAND–90-1755C
DE90017031	SAND–90-1756C
DE90017032	SAND–90-2282C
DE90017033	SAND–90-2317C
DE90017036	SAND–90-2191C
DE90017038	SAND–90-1323C
DE90017040	SAND–90-2272C
DE90017089	DOE/ID–10287
DE90017187	PNL-SA–17566
DE90017188	PNL-SA–17279
DE90017221	DOE/ER/13600–T4
DE90017238	PNL-SA–18353
DE90017239	PNL-SA–18095
DE90017240	PNL-SA–18290
DE90017248	DOE/PC/88802–T5
DE90017252	IS-M–627
DE90017253	IS-M–636
DE90017258	DOE/PC/88951–6
DE90017259	DOE/PC/88951–5
DE90017273	DOE/SF/16306–23
DE90017284	DOE/ER/40231–T8
DE90017286	DOE/ER/75425–T1
DE90017288	DOE/CE/90025–2
DE90017290	DOE/PC/79855–T1
DE90017291	DOE/PC/79855–T2
DE90017292	DOE/PC/79855–T3
DE90017293	DOE/PC/79855–T4
DE90017294	DOE/PC/79855–T5
DE90017311	ORNL/FTR–3713
DE90017312	ORNL/FTR–3731
DE90017317	CONF-9007167–1
DE90017318	FSU-HEP–890130
DE90017324	CONF-9009243–1
DE90017326	CONF-901025–6
DE90017327	CONF-900757–5
DE90017328	CONF-9004177–3
DE90017331	IS–4992
DE90017333	CONF-901199–10
DE90017334	CONF-9009174–1
DE90017336	DOE/ER/40319–3
DE90017337	FSU-HEP–041090

Order No.	Report No.
DE90017345	DOE/PC/79855–T6
DE90017346	DOE/PC/79855–T7
DE90017347	DOE/PC/79855–T8
DE90017348	DOE/PC/79855–T9
DE90017380	DOE/EIA–M041
DE90017403	DOE/ER/05490–112
DE90017404	CONF-900822–9
DE90017408	DOE/NASA/33408–4
DE90017426	IS-M–625
DE90017447	DOE/ER/13808–T1
DE90017448	CONF-9003159–2
DE90017449	FSU-HEP–881011
DE90017458	DOE/ER/60954–1
DE90017498	FNAL-TM–1674
DE90017500	ORNL/M–1250
DE90017502	ORNL/FTR–3721
DE90017503	ORNL/FTR–3724
DE90017508	DOE/OR/00033–T442
DE90017510	DOE/OR/00033–T444
DE90017511	DOE/OR/00033–T445
DE90017513	IS-IPRT–5
DE90017514	IS-IPRT–6
DE90017515	DOE/DP/10560–7
DE90017516	PNL–5895
DE90017517	PNL–7449
DE90017518	UCRL-JC–103762
DE90017519	UCRL-JC–104223-Rev.1
DE90017520	UCRL–102942
DE90017521	UCRL–102843
DE90017522	UCRL–102842
DE90017524	UCRL-JC–104361
DE90017525	UCRL-JC–104276
DE90017526	UCRL-JC–104721
DE90017527	UCRL-JC–103783
DE90017528	UCRL-JC–104665
DE90017533	WHC-EP–0275-Rev.2
DE90017558	ORNL/FTR–3729
DE90017559	ORNL/FTR–3716
DE90017561	DOE/ER/13968–T2
DE90017588	GA-A–20115
DE90017593	SAND–90-0881C
DE90017595	SAND–2033C
DE90017596	SAND–90-1126C
DE90017602	DOE/ER/60418–2
DE90017603	DOE/ER/60408–2
DE90017604	DOE/ER/60438–2
DE90017605	DOE/ER/53240–3
DE90017608	DOE/ER/45328–4
DE90017611	DOE/ER/45370–3
DE90017617	DOE/ET/53088–452
DE90017618	DOE/ET/53088–451
DE90017621	DOE/PC/90014–T7
DE90017627	ORNL/FTR–3739
DE90017628	BNL–45116
DE90017631	BNL–43923
DE90017632	BNL–45011
DE90017633	BNL–45009
DE90017634	BNL–45008
DE90017635	BNL–45010
DE90017636	BNL–45013
DE90017639	BNL–44911
DE90017645	PNL-SA–17678
DE90017646	PNL-SA–17865
DE90017647	KCP–613-4404
DE90017649	PNL–6450-34-HEDR
DE90017652	DOE/NV/10384–25
DE90017653	DOE/ER/13958–16
DE90017656	IS-T–1489
DE90017657	DOE/EIA–0534
DE90017659	CONF-9009251–1
DE90017661	CONF-9005270–1
DE90017662	CONF-9006270–1
DE90017663	CONF-900631–3
DE90017666	CONF-900450–11
DE90017667	CONF-9006243–3
DE90017669	CONF-900813–1
DE90017670	CONF-900623–17
DE90017672	CONF-900804–32
DE90017673	CONF-900801–29
DE90017674	CONF-9002131–3
DE90017675	CONF-900676–14
DE90017676	CONF-900534–4
DE90017678	CONF-900694–1
DE90017679	CONF-900631–4
DE90017680	CONF-900802–7
DE90017685	CONF-9007170–1
DE90017686	CONF-9007106–72
DE90017687	CONF-9010191–1
DE90017688	CONF-900975–1
DE90017689	CONF-901101–31
DE90017691	CONF-900623–18
DE90017692	CONF-9007141–3
DE90017694	CONF-9009123–2
DE90017695	CONF-901101–30
DE90017702	K/CSD/INF–89/42/R1
DE90017703	DOE/EIA–0130(90/06)
DE90017704	CONF-900562–8
DE90017722	DOE/ER/53297–2
DE90017725	DOE/RL–90-34
DE90017726	DOE/RL–90-17
DE90017727	WHC-SA–0483
DE90017728	WHC-EP–0063-1
DE90017729	WHC-SA–0821
DE90017730	ORNL/FTR–3725
DE90017731	ORNL/FTR–3732
DE90017732	IS–5009
DE90017734	IAEA-CN–53/C-4-7
DE90017735	CONF-900914–1
DE90017736	CONF-900936–4
DE90017740	CONF-901007–2
DE90017743	CONF-9009174–2
DE90017744	CONF-900936–6
DE90017745	CONF-901101–32
DE90017747	CONF-901067–1
DE90017755	TRI-PP–90-25
DE90017756	TRI-PP–90-22
DE90017757	TRI-PP–90-44
DE90017758	CONF-900731–2
DE90017759	CONF-900936–2
DE90017761	CONF-9009174–3
DE90017762	CONF-9009164–2
DE90017763	CONF-901105–11
DE90017768	CONF-900964–2
DE90017769	CONF-900936–5
DE90017774	DOE/ER/52127–72
DE90017775	DOE/ER/13491–450
DE90017784	DOE/AL/31950–T3
DE90017786	DOE/ER/60888–1-Vol.1
DE90017787	DOE/ER/60888–1-Vol.2
DE90017788	DOE/ER/60888–1-Vol.3
DE90017789	DOE/ER/60888–1-Vol.4
DE90017790	DOE/ER/60888–1-Vol.5
DE90017791	CONF-900819–1
DE90017797	CONF-900801–32
DE90017798	CONF-900577–3
DE90017800	CONF-900601–9
DE90017802	CONF-900579–2
DE90017805	CONF-9004209–7
DE90017806	CONF-900830–2
DE90017807	CONF-900601–8
DE90017809	CONF-900970–3
DE90017810	CONF-901057–1
DE90017812	CONF-900944–2
DE90017813	CONF-9009256–1
DE90017815	CONF-900936–3
DE90017817	CONF-9009108–1
DE90017819	CONF-9009123–3
DE90017822	CONF-901073–7
DE90017826	CONF-9009255–1
DE90017829	CONF-900873–2
DE90017830	CONF-900873–3
DE90017831	CONF-9006105–12
DE90017836	CONF-891119–140
DE90017838	CONF-900628–3
DE90017839	CONF-900802–10
DE90017840	DOE/ER/13846–3
DE90017842	ORNL/FTR–3742
DE90017843	ORNL/FTR–3730
DE90017844	ORNL/RASA–89/10
DE90017850	ORNL/FTR–3741
DE90017854	LA–11882-MS
DE90017855	LA–11895-MS
DE90017856	CONF-900466–85
DE90017857	CONF-900814–13
DE90017858	CONF-900801–33
DE90017861	CONF-900577–2
DE90017863	CONF-900623–19
DE90017865	CONF-900546–14
DE90017866	DOE/EIA–0202(90/3Q)
DE90017872	ORNL/FTR–3737
DE90017873	CONF-9004133–6
DE90017875	DOE/PC/90514–T10
DE90017877	DOE/PC/89769–T2
DE90017878	DOE/PC/79798–T7
DE90017879	DOE/PC/79919–13
DE90017886	DOE/PC/90274–T8
DE90017887	DOE/PC/80016–T9
DE90017888	DOE/PC/79925–7
DE90017889	DOE/PC/70507–T3
DE90017890	DOE/PC/90505–T6
DE90017891	DOE/PC/90505–T5
DE90017892	DOE/PC/91257–T6
DE90017893	DOE/PC/88923–T2
DE90017895	DOE/PC/89909–T1
DE90017899	LBL–22702
DE90018002	ANL/APS/TM–7
DE90018004	ANL/EAIS/TM–24
DE90018005	UCRL-ID–104571
DE90018006	UCRL-ID–104759
DE90018007	PNL–7441
DE90018008	PNL–7435
DE90018013	IS-M–641
DE90018014	IS-M–642
DE90018015	IS-M–647
DE90018016	IS-M–648
DE90018017	IS-M–649
DE90018018	FNAL-TM–1679
DE90018019	DOE/ER/53198–160
DE90018020	ANL/TM–423-Rev.2
DE90018021	DOE/ER–0463P
DE90018022	IS-M–650
DE90018023	LA–11915-MS
DE90018026	DOE/FE–197P
DE90018027	LA–11849-MS
DE90018028	LA–11671-MS
DE90018029	BNL–52244
DE90018030	ANL/APS-CP–3
DE90018032	ANL–89/29
DE90018037	ORNL/TM–11637
DE90018038	LA–11884-MS
DE90018039	IS-M–644
DE90018040	IS-M–638
DE90018041	IS-M–646
DE90018042	IS-M–640
DE90018043	IS-M–645
DE90018044	IS-M–639

Order No.	Report No.
DE90018045	IS-M-637
DE90018046	IS-M-643
DE90018047	LA-11907-MS
DE90018048	FNAL-TM-1678
DE90018049	FNAL-TM-1676
DE90018050	DOE/ER-0469P
DE90518708	NEI-FI-119
DE90519796	KFK-4716
DE90519861	GSF-HY-38/88
DE90519897	IKE-5-230
DE90520015	DLR-FB-90-18
DE90520190	PSC-6
DE90520194	NIFS-15
DE90520195	NIFS-14
DE90520196	NIFS-13
DE90520197	NIFS-12
DE90520198	NIFS-11
DE90520199	NIFS-10
DE90520206	INS-816
DE90520207	JAERI-M-90-061
DE90520208	JAERI-M-90-062
DE90520209	JAERI-M-90-063
DE90520210	JAERI-M-90-064
DE90520211	JAERI-M-90-067
DE90520212	JAERI-M-90-070
DE90520213	JAERI-M-90-072
DE90520218	JAERI-M-90-077
DE90520219	JAERI-M-90-076
DE90520220	JAERI-M-90-073
DE90520221	JAERI-M-90-066
DE90520222	JAERI-M-90-074
DE90520223	JAERI-M-90-071
DE90520224	JAERI-M-90-065
DE90520225	INS-818
DE90520226	INS-819
DE90520227	INS-820
DE90520234	KEK-PR-89-3
DE90520241	RERF-TR-4-90
DE90520258	INS-823
DE90520259	INS-822
DE90520260	INS-821
DE90520261	INS-T-496
DE90520262	JAERI-M-90-079
DE90520263	JAERI-M-90-081
DE90520264	JAERI-M-90-080
DE90520265	JAERI-M-90-068
DE90520328	RRK-90-9
DE90520329	PSC-7
DE90520331	JAERI-M-90-075
DE90520332	JAERI-M-90-084
DE90520333	JAERI-M-90-082
DE90520335	INS-828
DE90520336	INS-826
DE90520427	ISAS-SP-10
DE90520440	NIRS-AR-31
DE90520441	NIRS-RSD-89
DE90520442	NIRS-RSD-88
DE90520443	NIRS-27
DE90520444	NIRS-26
DE90520450	NIFS-DATA-1
DE90636742	IAEA-R-4297-F
DE90638959	CTH-IEFT-PP-1990-03
DE90639714	IPEN-PUB-174
DE90640167	DOE-RW-89.106(v.1)
DE90640168	DOE-RW-89.106(v.2)
DE90640169	DOE-RW-89.106(v.3)
DE90640174	SKN-35
DE90706194	ND-R-1173(S)-Pt.2
DE90706209	RAL-90-022
DE90706210	INIS-mf-12110
DE90706211	INIS-mf-12114
DE90706212	INIS-mf-12113
DE90706213	KIFVE-88-09
DE90706214	JINR-2-35-89
DE90706215	KIFVE-88-08
DE91000005	DOE/PC/79925-11
DE91000016	MLM-3656(OP)
DE91000019	UCRL-CR-104589
DE91000021	SAND-90-1008C
DE91000026	SAND-90-1346C
DE91000035	SAND-90-2108C
DE91000043	SAND-2302C
DE91000060	KCP-613-4118
DE91000119	BNL-44625
DE91000120	BNL-43928
DE91000122	BNL-45004
DE91000128	DOE/ET/53088-447
DE91000134	K/ETO-34
DE91000148	DOE/ET/53088-450
DE91000180	LBL-29361
DE91000196	IS-T-1474
DE91000214	LA-UR-90-3255
DE91000249	LBL-28189
DE91000253	UCRL-JC-103825
DE91000258	UCRL-JC-103797
DE91000398	CONF-901101-33
DE91000557	CONF-9009174-4
DE91600476	BARC-1479
DE91600477	IFVE-OTF-89-80
DE91600481	IAE-4757-1
DE91600482	IFUSP-P-800
DE91600483	IFUSP-P-836
DE91600486	ITEF-93-89
DE91600487	JINR-R-11-89-188
DE91600488	KFTI-88-36
DE91600504	JINR-R-2-89-182
DE91600505	JINR-R-2-89-224
DE91600515	CBPF-NF-003/89
DE91600516	IFUSP-P-834
DE91600517	IFUSP-P-842
DE91600518	IFVE-OTF-88-147
DE91600520	ITF-88-111
DE91600521	ITF-88-176
DE91600522	ITP-88-156
DE91600523	JINR-E-2-89-39
DE91600524	JINR-E-4-89-19
DE91600525	JINR-R-2-88-940
DE91600566	IFUSP-P-837
DE91600567	IFUSP-P-838
DE91600608	IAE-4754-6
DE91600611	KFTI-88-22
DE91600635	CBPF-NF-006/89
DE91600636	IFUSP-P-827
DE91600641	IYaF-89-49
DE91600642	JINR-E-14-89-128
DE91600711	IAE-4727-1
DE91600712	JINR-14-89-462
DE91600764	IAE-4775-8
DE91600765	IAE-4767-6
DE91600766	IAE-4827-6
DE91600803	ITEF-78-89
DE91600804	ITF-89-2
DE91600805	KFTI-88-26
DE91600815	IAE-4784-7
DE91600816	IAE-4785-7
DE91600817	IAE-4838-7
DE91600824	IPPCZ-293/III
DE91600844	IAE-4787-8
DE91600845	IAE-4848-16
DE91600853	BARC-1489
DE91600854	IAE-4740-6
DE91600855	IAE-4756-6
DE91600856	KFTI-88-46
DE91600864	ITF-88-110
DE91600865	ITF-88-146
DE91600866	ITF-88-157
DE91600867	KFTI-88-21
DE91600868	KFTI-88-35
DE91600899	IAE-4853-16
DE91600900	KFTI-88-34
DE91600901	IAE-4792-8
DE91600903	IAE-4702-16
DE91600904	ITEF-87-89
DE91600905	ITEF-89-89
DE91600926	ITF-88-86
DE91600932	IAE-4840-1
DE91600933	ITP-89-4
DE91600962	ITF-88-174
DE91600963	ITP-88-167
DE91600964	ITP-88-168
DE91600982	CBPF-NF-001/89
DE91600990	IAE-4828-6
DE91600999	IFVE-OUNK-89-114
DE91601023	IAE-4833-2
DE91601025	IFVE-OTF-89-136
DE91601028	IFUSP-P-814
DE91601029	IFVE-ONF-89-94
DE91601030	ITF-88-145
DE91601031	JINR-E-2-89-145
DE91601032	RAL-90-030
DE91601038	ITP-88-116
DE91601048	IAE-4904-1
DE91601049	IFVE-ONF-89-93
DE91601050	IFVE-OTF-88-148
DE91601051	IFVE-OTF-89-110
DE91601052	IFVE-OTF-89-111
DE91601053	IFVE-OTF-89-140
DE91601054	IFVE-OTF-89-144
DE91601055	IFVE-OTF-89-66
DE91601056	IFVE-OTF-89-75
DE91601057	IFVE-OTF-89-87
DE91601059	ITEP-121-88
DE91601060	ITEP-131-88
DE91601061	ITEP-152-88
DE91601062	ITF-88-104
DE91601063	ITP-88-117
DE91601064	ITP-88-175
DE91601065	JINR-R-1-89-64
DE91601066	JINR-R-2-89-86
DE91601068	KIFVE-88-15
DE91601097	CBPF-NF-009/89
DE91601098	ITP-88-126
DE91601103	HEPI-88-17
DE91601104	IFVE-OTF-89-88
DE91601108	IFVE-OEF-89-95
DE91601115	IAE-4774-5
DE91601116	INDC(CCP)-314
DE91601118	IFUSP-P-839
DE91601123	FEI-1958
DE91601124	JINR-E-4-89-165
DE91601125	JINR-E-4-89-211
DE91601126	JINR-E-4-89-51
DE91601158	IAE-4761-2
DE91601160	ITEP-144-88
DE91601161	ITP-88-158
DE91601162	ITP-89-3
DE91601163	JINR-E-2-89-37
DE91601164	JINR-R-1-89-47
DE91601167	KIFVE-87-19
DE91601171	KIFVE-88-12
DE91601219	IAE-4762-2
DE91601220	IAE-4876-2
DE91601229	FEI-1917
DE91601230	IAEA-NDS-114(Rev.0)
DE91601232	IAEA-NDS-116(Rev.0)
DE91601233	IAEA-NDS-51(Rev.2)

Order No.	Report No.
DE91601234	IAEA-NDS-90(Rev.2)
DE91601235	IAEA-NDS-96(Rev.0)
DE91601237	ITEF-138-88
DE91601238	IYF-88-01/A
DE91601239	IYF-88-03
DE91601240	JINR-E-7-89-126
DE91601241	KIFVE-88-16
DE91601248	ITEF-96-89
DE91601252	INDC(CCP)-313
DE91601267	INDC(CCP)-312
DE91601302	IAE-4869-2
DE91601345	BARC-1484
DE91601346	ESTD-L-0104/R89
DE91601385	PSI-73
DE91601427	BARC-1473
DE91601444	IPEN-PUB-286
DE91601445	JINR-R-6-89-190
DE91601482	CDTN-432
DE91601488	BARC-1482
DE91601489	BARC-1486
DE91601512	KFTI-88-33
DE91601513	KFTI-88-41
DE91601550	IPEN-PUB-129
DE91601671	KFTI-88-38
DE91601676	CBPF-NF-043/86
DE91601677	ITF-88-127
DE91601716	JINR-E-12-89-162
DE91601717	KFTI-88-27
DE91601970	IAEA-INFCIRC-383
DE91601974	ANSTO/E-688
DE91601980	BARC-1483
DE91601981	BARC-1492
DE91602119	IPEN-PUB-294
DE91602252	FEI-1946
DE91602254	JINR-9-89-118
DE91602257	EFI-1013(63)-87
DE91602268	ITEF-110-89
DE91602269	ITEF-169-88
DE91602270	KFTI-88-19
DE91602287	EFI-1008(58)-87
DE91602288	EFI-1035(85)-87
DE91602289	FEI-1950
DE91602294	EFI-1021(71)-87
DE91602295	EFI-1025(75)-87
DE91602296	IFVE-OLU-89-86
DE91602297	IFVE-OLU-89-97
DE91602298	IFVE-OMVT-89-104
DE91602303	ITEP-156-88
DE91602315	EFI-1018(68)-87
DE91602316	EFI-988(38)-87
DE91602317	IFVE-OLU-89-126
DE91602329	ITEF-102-89
DE91602330	JINR-E-1-89-291
DE91602331	JINR-E-16-89-59
DE91602363	IFVE-OEF-89-56(E-581/E-704)
DE91602378	FEI-1942
DE91602379	IAE-4691-4
DE91602380	IAE-4797-4
DE91602381	ITEF-164-88
DE91602382	UJV-8855-R
DE91602383	IAE-4647-3
DE91602411	NIIAR-28-759
DE91602421	IWGRRPC-88-2
DE91602442	ESTD-L-0108/R89
DE91602443	IAEA-TC-560.03
DE91602463	IPEN-PUB-172
DE91602511	UJV-8605-R,T
DE91602512	UJV-8981-T
DE91602513	UJV-8982-T
DE91602523	ITEF-38-89
DE91602524	ITEF-39-89
DE91602525	ITEF-40-89
DE91602533	IFVE-ORI-89-123
DE91602537	IAE-4741-4
DE91602538	IAE-4849-14
DE91602539	ITEF-58-89
DE91602540	JINR-R-13-89-115
DE91602541	JINR-13-89-164
DE91602548	EFI-1017(67)-87
DE91602549	EFI-995(45)-87
DE91602550	IFVE-OEF-89-103
DE91602551	IFVE-OEF-89-105
DE91602552	IFVE-OEF-89-131
DE91602553	IFVE-OEF-89-99
DE91602554	IFVE-ONF-89-135
DE91602555	ITEF-77-89
DE91602556	JINR-R-1-89-206
DE91602557	JINR-R-1-89-87
DE91602565	EFI-1000(50)-87
DE91602566	EFI-1022(72)-87
DE91602567	EFI-1045(8)-88
DE91602597	IFVE-OMVT-89-42
DE91602598	IFVE-OP-89-127
DE91602599	IFVE-OP-89-129
DE91602603	IYaF-88-104
DE91602604	IYaF-88-22
DE91602605	IYaF-88-93
DE91602608	IFVE-OEF-89-102
DE91602616	DOE-RW-89.107
DE91602626	IAEA-TECDOC-555
DE91602644	IAEA-INFCIRC-209(Mod.2/Add.3)
DE91602645	IAEA-INFCIRC-209(Mod.3/Add.3)
DE91602646	IAEA-INFCIRC-209(Mod.4/Add.1)
DE91602654	IAEA-INFCIRC-380
DE91602673	IAEA-INFCIRC-278(Corr.1)
DE91602674	IAEA-INFCIRC-376
DE91602675	IAEA-INFCIRC-378
DE91602676	IAEA-INFCIRC-381
DE91602677	IAEA-INFCIRC-382
DE91602680	IAEA-NDS-0(Rev.90/1)
DE91602681	IAEA-NDS-23(Rev.3)
DE91602682	IAEA-NDS-7(Rev.90/1)
DE91602685	ITEF-88-89
DE91602686	IYaF-88-23
DE91602691	UJV-9040-V
DE91602692	OUP-90-10
DE91700291	CEA-DAS-672
DE91700310	CEA-DAS-STAS-SPI-1
DE91700485	CEA-CONF-10026
DE91700488	CEA-N-2640
DE91700504	CEA-CONF-10040
DE91700506	CEA-CONF-10024
DE91700508	CEA-CONF-10033
DE91700510	CEA-CONF-10037
DE91700515	CEA-CONF-10029
DE91700516	CEA-CONF-10028
DE91700534	CEA-CONF-10032
DE91700538	IPNO-DRE-89-21
DE91700540	CEA-CONF-9890
DE91700542	CEA-CONF-9885
DE91700544	CEA-CONF-9884
DE91700548	CEA-CONF-9407
DE91700550	CEA-CONF-9880
DE91700552	CEA-DAS-617
DE91700556	FRCEA-TH-209
DE91700560	FRNC-TH-3538
DE91700562	IPNO-DRE-89-25
DE91700564	CRN-VIV-64
DE91701147	AFME-83-2434
DE91701148	FRNC-R-161
DE91701149	AFME-85-06-1096
DE91701150	AFME-85-05-1061
DE91701151	PIRSEM-2012
DE91701152	AFME-86-91-0001
DE91701154	AFME-85-09-1106-3
DE91701155	AFME-82-066-7
DE91701156	AFME-82-066-2
DE91701157	AFME-84.2242
DE91701158	AFME-86-04-0038
DE91701159	FRNC-TH-3645
DE91701160	CEA-CONF-9684
DE91701169	IFP-37748-1
DE91701170	AFME-84-1724-6
DE91701171	AFME-85-91-1003-1
DE91701172	AFME-84-1724-4
DE91701174	EDF-DER-RA-1989-2
DE91701391	CRIE-U-89046
DE91701399	CRIE-U-89030
DE91701400	CRIE-U-89034
DE91701401	CRIE-U-89035
DE91701404	CRIE-Y-90001
DE91701405	CRIE-Y-90002
DE91701407	CRIE-U-89036
DE91701408	CRIE-U-89015
DE91701409	CRIE-U-89032
DE91701463	NEDO-P-8927
DE91701464	NEDO-P-8936
DE91701465	NEDO-P-8919
DE91701466	NEDO-P-8951
DE91701467	NEDO-P-8952
DE91701468	NEDO-P-8953
DE91701469	NEDO-P-2950
DE91702073	CEA-N-2624
DE91702077	CEA-DAS-668
DE91702081	CEA-N-2629
DE91702088	CEA-DAS-669
DE91702089	CEA-DAS-666
DE91702090	FRCEA-TH-283
DE91702093	FRCEA-TH-292
DE91702094	CEA-CONF-9976
DE91702095	CEA-CONF-9955
DE91702096	CEA-CONF-9959
DE91702098	GANIL-P-8921
DE91702099	FRNC-R-322
DE91702100	LAL-8935
DE91702102	FRCEA-TH-289
DE91702103	CENBG-8938
DE91702104	CENBG-8937
DE91702111	ESA-SP-290
DE91702151	CRN-HE-8906
DE91702152	FRCEA-TH-288
DE91702163	CEA-R-5523
TI90016060	EUR-11888
TI90016068	EUR-12097
TI90016075	EUR-12166
TI90016076	EUR-12289
TI90016082	EUR-12246
TI90016451	EUR-12110
TI90016454	EUR-12099
TI90016455	EUR-12046
TI90016694	DOE/MA-0417P
TI90016905	'NUREG-0750-Vol.32-No.1
TI90017409	OCS/EIS/EA/MMS-90-0042-Vol.1
TI90017410	OCS/EIS/EA/MMS-90-0042-Vol.2
TI90017530	NUREG/CR-5451
TI90017540	BR-82(11.118)
TI90017622	FWS/OBS-82/15
TI90017623	FWS/OBS-82/16
TI90017624	FWS/OBS-82/46
TI90017625	FWS/OBS-81/03

Order No.	*Report No.*
TI90017626	FWS/OBS–80/23
TI90017638	NUREG–0940-Vol.9-No.2
TI90017651	NUREG/CR–5575
TI90017696	NUREG/CR–4624-Vol.6
TI90017697	NUREG–0540-Vol.12-No.7
TI90017698	NUREG/CP–0112-Vol.2
TI90017699	NUREG/CR–5395-Vol.11
TI90017700	NUREG/CR–5395-Vol.11-Add.
TI90017778	EUR–12235
TI90017779	EUR–12466
TI90017780	EUR–12480
TI90017781	EUR–12517
TI90017782	EUR–12533
TI90017785	NUREG/CP–0112-Vol.1
TI90017869	NUREG–0304-Vol.15-No.2
TI91000135	NUREG/CR–5254
TI91000362	NUREG/CR–5554
TI91000422	NUREG/CR–5640
TI91000571	NUREG/CR–2000-Vol.9-No.8

Codes Used on Index Lines

Following the citation numbers in the Corporate Author, Personal Author, and Subject Indexes, codes are used to designate the type of document, country of publication, and language of the document, e.g., (R;SU;In Russian). The language designator does not appear if the document is published in English.

Document Types

J	Journal article
TJ	Translation of a journal article
R	Report
RA	Report analytic
B	Book
BA	Book analytic
P	Patent
E	Engineering materials
D	Dissertation
TG	Translation (general)
TA	Translation (analytic)

Country Codes

AD	Andorra
AE	United Arab Emirates
AF	Afghanistan
AL	Albania
AR	Argentina
AT	Austria
AU	Australia
BB	Barbados
BD	Bangladesh
BE	Belgium
BG	Bulgaria
BH	Bahrain
BI	Burundi
BJ	Benin
BM	Bermuda
BO	Bolivia
BR	Brazil
BS	Bahamas
BT	Bhutan
BU	Burma
BW	Botswana
BY	Byelorussian Soviet Socialist Republic (Byelorussian SSR)
CA	Canada
CB	Khmer Republic
CF	Central African Republic
CG	Congo
CH	Switzerland
CI	Ivory Coast
CL	Chile
CM	United Republic of Cameroon
CN	China
CO	Colombia
CR	Costa Rica
CS	Czechoslovakia
CU	Cuba
CY	Cyprus
DD	German Democratic Republic
DE	Germany, Fed. Republic of (F.R. Germany)
DK	Denmark
DO	Dominican Republic
DZ	Algeria
EC	Ecuador
EG	Egypt
ES	Spain
ET	Ethiopia
FI	Finland
FJ	Fiji
FR	France
GA	Gabon
GB	United Kingdom of Great Britain and Northern Ireland (UK)
GD	Grenada
GH	Ghana
GM	Gambia
GN	Guinea
GQ	Equatorial Guinea
GR	Greece
GT	Guatemala
GU	Guam
GW	Guinea-Bissau
GY	Guyana
HK	Hong Kong
HN	Honduras
HT	Haiti
HU	Hungary
HV	Upper Volta
ID	Indonesia
IE	Ireland
IL	Israel
IN	India
IQ	Iraq
IR	Iran
IS	Iceland
IT	Italy
JM	Jamaica
JO	Jordan
JP	Japan
KE	Kenya
KH	Democratic Kampuchea
KP	Democratic People's Republic of Korea
KR	Korea, Republic of
KW	Kuwait
LA	Laos
LB	Lebanon
LI	Liechtenstein
LK	Sri Lanka
LR	Liberia
LS	Lesotho
LU	Luxembourg
LY	Libyan Arab Republic
MA	Morocco
MC	Monaco
MG	Madagascar
ML	Mali
MN	Mongolia
MR	Mauritania
MT	Malta
MU	Mauritius
MV	Maldives
MW	Malawi
MX	Mexico
MY	Malaysia
NE	Niger
NG	Nigeria
NI	Nicaragua
NL	Netherlands
NO	Norway
NP	Nepal
NR	Nauru
NZ	New Zealand
OM	Oman
PA	Panama
PE	Peru
PG	Papua New Guinea
PH	Philippines
PK	Pakistan
PL	Poland
PR	Puerto Rico
PT	Portugal
PY	Paraguay
QA	Qatar
RH	Southern Rhodesia
RO	Romania
RW	Rwanda
SA	Saudi Arabia
SD	Sudan
SE	Sweden
SG	Singapore
SK	Sikkim
SL	Sierra Leone
SM	San Marino
SN	Senegal
SO	Somalia
SU	Union of Soviet Socialist Republics (USSR)
SV	El Salvador
SY	Syria
SZ	Swaziland
TD	Chad
TG	Togo
TH	Thailand
TN	Tunisia
TO	Tonga
TR	Turkey
TT	Trinidad and Tobago
TW	Taiwan
TZ	United Republic of Tanzania
UA	Ukrainian Soviet Socialist Republic (Ukrainian SSR)
UG	Uganda
US	United States of America (USA)
UY	Uruguay
VA	Holy See
VE	Venezuela
VI	Virgin Islands of the United States
VN	Viet Nam
WS	Western Samoa
YD	Democratic Yemen
YE	Yemen
YU	Yugoslavia
ZA	South Africa
ZM	Zambia
ZR	Zaire
ZW	Zimbabwe

*U.S.GOVERNMENT PRINTING OFFICE:1990-548-133:20012

ORDER FORM

DOE and DOE Contractors: Fill in Parts I, II, and IV. **Others:** Fill in Parts I, III, and IV. Mark appropriate blanks in Part IV to indicate quantity and form (microfiche or paper copy).

I. SHIPPING AND PAYMENT INFORMATION

Ordering Address

Name _____ Telephone _____

Address _____

City _____ State _____ Zip _____

Shipping Address (if different from above)

Name _____

Address _____

City _____ State _____ Zip _____

_____

SIGNATURE (Required to validate ALL orders)

II. OSTI ORDERS (DOE and DOE contractors can order from OSTI.)

☐ Charge OSTI deposit account no. _____

Mail orders to: U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

III. NTIS ORDERS

☐ Charge NTIS deposit account no.

☐ Check/Money Order enclosed for $

☐ Charge to my ☐ American Express ☐ VISA ☐ Mastercard

_____ _____
Account Number **Card expiration date**

☐ Ship and Bill (see below for restrictions)

Employer identification number (9 digits) _ _–_ _ _ _ _ _ _

Purchase Order number _____

Phone number of billing office _____
(Required for Ship & Bill orders)

Ship & Bill service is restricted to North American business locations for an extra $7.50 per order (or per Custom Search). The business' employer identification number plus the phone number of the office paying the bill are required to process these requests. A late payment charge will be applied to billings more than 30 days overdue. Prepaying, using an NTIS Deposit Account or a charge account, speeds order processing. Be sure payment and order are sent together. Checks, payable to NTIS, must be in U.S. dollars.

Mail orders to: U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

IF NO METHOD OF PAYMENT IS INDICATED, YOUR ORDER WILL BE RETURNED TO YOU AS A PRICE QUOTE UNPROCESSED.

IV. SELECTIONS

Order number _____ Report number _____

Abstract number (with vol., issue) _____

No. of fiche _____ No. of paper copies _____

Order number _____ Report number _____

Abstract number (with vol., issue) _____

No. of fiche _____ No. of paper copies _____

Order number _____ Report number _____

Abstract number (with vol., issue) _____

No. of fiche _____ No. of paper copies _____

Order number _____ Report number _____

Abstract number (with vol., issue) _____

No. of fiche _____ No. of paper copies _____

Order number _____ Report number _____

Abstract number (with vol., issue) _____

No. of fiche _____ No. of paper copies _____

Order number _____ Report number _____

Abstract number (with vol., issue) _____

No. of fiche _____ No. of paper copies _____

CUT OUT APPROPRIATE FORM AND MAIL IN A STAMPED ENVELOPE TO THE ADDRESS INDICATED.

Change of Address Form

NAME–FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

PLEASE PRINT OR TYPE

(or) COUNTRY

MAIL THIS FORM TO:

NEW ADDRESS
Superintendent of Documents
Government Printing Office SSOM
Washington, D.C. 20402

Attach last subscription label here.

Subscription Order Form

Enter my Subscription to: _____
(Please indicate publication)

@ $ _____ Domestic; @ $ _____ Foreign.

NAME–FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

PLEASE PRINT OR TYPE

(or) COUNTRY

☐ Remittance Enclosed (Make checks payable to Superintendent of Documents)

☐ Charge to my Deposit Account No. _____

MAIL ORDER FORM TO:
Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

Federal Depository Library Program

As a result of an agreement between the U.S. Government Printing Office (GPO) and the Department of Energy, beginning in 1984 DOE reports with unlimited distribution are now included in the Federal Depository Library Program. The Regional Depository Libraries listed below receive and retain at least one copy of nearly every Federal Government publication, either in printed or microfilm form, for use by the general public. These libraries provide reference services and interlibrary loans; however, they are not sales outlets. You may wish to ask your local library to contact a Regional Depository to help you locate specific publications, or you may contact the Regional Depository yourself. Do not send checks or orders to these libraries.

ARKANSAS STATE LIBRARY
One Capitol Mall
Little Rock, AR 72201
(501) 371-2326

AUBURN UNIV. AT MONTGOMERY LIBRARY
Documents Department
Montgomery, AL 36193
(205) 279-9110, ext. 253

UNIV. OF ALABAMA LIBRARY
Documents Dept.-Box S
University, AL 35486
(205) 348-7369

DEPT. OF LIBRARY, ARCHIVES AND PUBLIC RECORDS
Third Floor-State Cap.
1700 West Washington
Phoenix, AZ 85007
(602) 255-4121

UNIVERSITY OF ARIZONA LIB.
Government Documents Dept.
Tucson, AZ 85721
(602) 626-5233

CALIFORNIA STATE LIBRARY
Govt. Publications Section
P.O. Box 2037
Sacramento, CA 95809
(916) 322-4572

UNIV. OF COLORADO LIB.
Government Pub. Division
Campus Box 184
Boulder, CO 80309
(303) 492-8834

DENVER PUBLIC LIBRARY
Govt. Pub. Department
1357 Broadway
Denver, CO 80203
(303) 571-2131

CONNECTICUT STATE LIBRARY
Government Documents Unit
231 Capitol Avenue
Hartford, CT 06106
(203) 566-4971

UNIV. OF FLORIDA LIBRARIES
Library West
Documents Department
Gainesville, FL 32611
(904) 392-0367

UNIV. OF GEORGIA LIBRARIES
Government Reference Dept.
Athens, GA 30602
(404) 542-8951

UNIV. OF HAWAII LIBRARY
Govt. Documents Collection
2550 The Mall
Honolulu, HI 96822
(808) 948-8230

UNIV. OF IDAHO LIBRARY
Documents Section
Moscow, ID 83843
(208) 885-6344

ILLINOIS STATE LIBRARY
Information Services Branch
Centennial Building
Springfield, IL 62706
(217) 782-5185

INDIANA STATE LIBRARY
Serials Documents Section
140 North Senate Avenue
Indianapolis, IN 46204
(317) 232-3686

UNIV. OF IOWA LIBRARIES
Govt. Documents Department
Iowa City, IA 52242
(319) 353-3318

UNIVERSITY OF KANSAS
Doc. Collect.-Spencer Lib.
Lawrence, KS 66045
(913) 864-4662

UNIV. OF KENTUCKY LIBRARIES
Govt. Pub. Department
Lexington, KY 40506
(606) 257-3139

LOUISIANA STATE UNIVERSITY
Middleton Library
Govt. Docs. Dept.
Baton Rouge, LA 70803
(504) 388-2570

LOUISIANA TECHNICAL UNIV. LIBRARY
Documents Department
Ruston, LA 71272
(318) 257-4962

UNIVERSITY OF MAINE
Raymond H. Fogler Library
Tri-State Regional Documents Depository
Orono, ME 04469
(207) 581-1680

UNIVERSITY OF MARYLAND
McKeldin Lib.-Doc. Div.
College Park, MD 20742
(301) 454-3034

BOSTON PUBLIC LIBRARY
Government Docs. Dept.
Boston, MA 02117
(617) 536-5400 ext. 226

DETROIT PUBLIC LIBRARY
Sociology Department
5201 Woodward Avenue
Detroit, MI 48202
(313) 833-1409

MICHIGAN STATE LIBRARY
P.O. Box 30007
Lansing, MI 48909
(517) 373-0640

UNIVERSITY OF MINNESOTA
Government Pubs. Division
409 Wilson Library
309 19th Avenue South
Minneapolis, MN 55455
(612) 373-7813

UNIV. OF MISSISSIPPI LIB.
Documents Department
University, MS 38677
(601) 232-5857

UNIV. OF MONTANA
Mansfield Library
Documents Division
Missoula, MT 59812
(406) 243-6700

NEBRASKA LIBRARY COMM.
Federal Documents
1420 P Street
Lincoln, NE 68508
(402) 471-2045
(in cooperation with University of Nebraska-Lincoln)

UNIVERSITY OF NEVADA LIB.
Govt. Pub. Department
Reno, NV 89557
(702) 784-6579

NEWARK PUBLIC LIBRARY
5 Washington Street
Newark, NJ 07101
(201) 733-7812

UNIVERSITY OF NEW MEXICO
Zimmerman Library
Government Pub. Dept.
Albuquerque, NM 87131
(505) 277-5441

NEW MEXICO STATE LIBRARY
Reference Department
325 Don Gaspar Avenue
Santa Fe, NM 87501
(505) 827-2033, ext. 22

NEW YORK STATE LIBRARY
Empire State Plaza
Albany, NY 12230
(518) 474-5563

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL
Wilson Library
BA/SS Documents Division
Chapel Hill, NC 27515
(919) 962-1321

UNIVERSITY OF NORTH DAKOTA
Chester Fritz Library
Documents Department
Grand Forks, ND 58202
(701) 777-2617, ext. 27
(in cooperation with North Dakota State Univ. Library)

STATE LIBRARY OF OHIO
Documents Department
65 South Front Street
Columbus, OH 43215
(614) 462-7051

OKLAHOMA DEPT. OF LIBRARIES
Government Documents
200 NE 18th Street
Oklahoma City, OK 73105
(405) 521-2502

OKLAHOMA STATE UNIV. LIB.
Documents Department
Stillwater, OK 74078
(405) 624-6546

PORTLAND STATE UNIV. LIB.
Documents Department
P.O. Box 1151
Portland, OR 97207
(503) 229-3673

STATE LIBRARY OF PENN.
Government Pub. Section
P.O. Box 1601
Harrisburg, PA 17105
(717) 787-3752

TEXAS STATE LIBRARY
Public Services Department
P.O. Box 12927-Cap. Sta.
Austin, TX 78753
(512) 471-2996

TEXAS TECH. UNIV. LIBRARY
Govt. Documents Department
Lubbock, TX 79409
(806) 742-2268

UTAH STATE UNIVERSITY
Merrill Library, U.M.C. 30
Logan, UT 84322
(801) 750-2682

UNIVERSITY OF VIRGINIA
Alderman Lib.-Public Doc.
Charlottesville, VA 22901
(804) 924-3133

WASHINGTON STATE LIBRARY
Documents Section
Olympia, WA 98504
(206) 753-4027

WEST VIRGINIA UNIV. LIB.
Documents Department
Morgantown, WV 26506
(304) 293-3640

MILWAUKEE PUBLIC LIBRARY
814 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 278-3000

ST. HIST. LIB. OF WISCONSIN
Government Pub. Section
816 State Street
Madison, WI 53706
(608) 262-4347

WYOMING STATE LIBRARY
Supreme Ct. & Library Bld.
Cheyenne, WY 82002
(307) 777-6344

Order Number Correlation
Report Number Index
Contract Number Index
Subject Index
Personal Author Index
Corporate Author Index